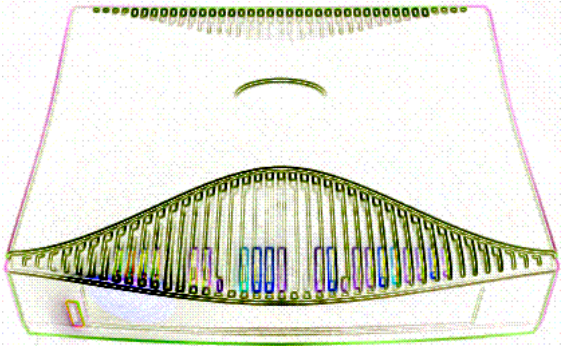
NETOPIA™ R5000 SERIES ROUTERS

R5100 Serial Router
R5200 DDS Router
R5300 T1 Router

User's Reference Guide



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Part Number

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(P/N 6160016-00-02)

Contents

Welcome to the Netopia R5000 Series Router *User's Reference Guide*. This guide is designed to be your single source for information about your Netopia R5000 Series Router. It is intended to be viewed on-line, using the powerful features of the Adobe Acrobat Reader. The information display has been designed to present the maximum information in the minimum space on your screen. You can keep this document open while you perform any of the procedures described and find useful information about the procedure you are performing.

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Part II: Advanced Configuration

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Part I: Getting Started

Chapter 1

Introduction

Overview

The Netopia R5000 Series Router line consists of the R5100 Serial Router, the R5200 DDS Router, and the R5300 T1 Router. Each is a full-featured, stand-alone, multiprotocol router for connecting diverse local area networks (LANs) to the Internet and other remote networks.

Netopia's high-speed, leased line routers provide Internet service at 56K DDS, Fractional T1/E1, and T1/E1 speeds to give any branch, small-to-medium-sized office, or school a full-time presence on the Internet. With built-in ease of use features, Netopia R5000 Series Routers provide an intuitive way to connect your network to the Internet. As with all Netopia Routers, the leased line models come packaged as a complete solution, including the necessary software, cables, and services to get you quickly connected to the Internet or corporate Intranet.

Once your Netopia R5000 Series Router is connected to your computer, and your account is activated by your frame and Internet service providers, you will have a clean, high-speed connection to the outside world.

This section covers the following topics:

Features and capabilities

Netopia R5000 Series Routers provide the following features:

- From 56K to 2.0 Mbps Serial, 56K DDS, and Fractional T1/T1 Models
- Built-in 8-port Ethernet hub with uplink port to easily connect the router to workstations or other 10Base-T hubs
- Built-in basic firewall with IP or IPX packet filtering
- Support for Frame Relay, PPP, and Cisco-HDLC encapsulation
- SmartMatch automatic detection of Frame Relay parameters
- Support for IP and IPX routing for Internet and intranet connectivity
- IP address serving (over Ethernet or a WAN link) that allows local or remote network nodes to acquire an IP address automatically and dynamically from a designated pool of available addresses
- Continuous-availability networking, eliminating dialing and providing lower, more predictable transmission

costs

- Status lights (LEDs) for easy monitoring and troubleshooting
- Support for console-based management over Telnet or serial cable connection
- Support for remote configuration by your reseller, your network administrator, or technicians at Netopia, Inc., via external modem or via IP network
- Wall-mountable, bookshelf (side-stackable), or desktop-stackable design for efficient space usage
- Network Address Translation (NAT) to protect the identity of LAN IP addresses from would-be intruders by representing all LAN IP addresses to the Internet or remote network as a single address. Design allows multiple servers (Web, mail, ftp, etc.) on the LAN to be accessible to the Internet.
- AppleTalk support (available as a separate add-on AppleTalk kit, including a firmware feature set enhancement and custom HD-15 dual RJ-11 PhoneNET® connector), allowing for LocalTalk-to-Ethernet routing, assigning IP addresses to Macintosh users (MacIP), IP functionality for LocalTalk users, and AURP tunneling for connectivity between remote AppleTalk networks
- Web-based monitoring of router status and budget management through a selection of forms in a web-browser. (Internet browsers such as Netscape Navigator and Microsoft's Internet Explorer are supplied on the Netopia CD.)
- Near-term firmware upgrade will support built-in secure Virtual Private Networks (VPN) and Multi-NAT, a NAT implementation that allows a combination of one-to-one and one-to-many NAT on the same physical or tunneled connection.

How to use this guide

This guide is designed to be your single source for information about your Netopia R5000 Series Router. It is intended to be viewed on-line, using the powerful features of the Adobe Acrobat Reader. The information display has been deliberately designed to present the maximum information in the minimum space on your screen. You can keep this document open while you perform any of the procedures described and find useful information about the procedure you are performing.

If you prefer to work from hard copy rather than on-line documentation, you can also print out all of the manual, or individual sections. The pages are formatted to print on standard 8 1/2 by 11 inch paper. We recommend that you print on three-hole punched paper, so you can put the pages in a binder for future reference. For your convenience, a printed copy can be purchased from Netopia. Order part number TER5000/Doc.

This guide is organized into chapters describing the Netopia R5000 Series's advanced features. You may want to read each chapter's introductory section to familiarize yourself with the various features available.

Use the guide's table of contents and index to locate informational topics.

Chapter 2

Setting Up Internet Services

This chapter describes how to obtain and set up Internet services.

This section covers the following topics:

Note: Some companies act as their own ISP. For example, some organizations have branch offices that can use the Netopia R5000 Series to access the Internet via the main office. If you install the Netopia R5000 Series in this type of environment, refer to the following sections for specific information you must receive from the network administrator to configure the Netopia R5000 Series properly.

Finding an Internet service provider

Internet access is available from Internet service providers (ISPs). Typically, there are several ISPs in each area. To locate ISPs in your area, consult your telephone book, local computer magazines, the business section of a local newspaper, or the following URL on the Internet: 'http://www.thelist.com'. Also see Netopia's home page at 'http://www.netopia.com' for a list of special programs and promotions for Netopia customers.

If your area has more than one ISP, the following considerations may help you decide which ISP is best suited for your requirements.

Use an ISP that provides Internet access through a digital line.

Digital line access combinations

Type of Service	Data Rate Speed	Datalink Protocol
DDS/ADN	• 56 - 64 kbps	PPP, HDLC, Frame Relay
T1	• 56 kbps - 1.544 mbps (Fractional T1) • 1.544 mbps (T1)	PPP, HDLC, Frame Relay
E1	• 64 kbps - 2.0 mbps	PPP, HDLC, Frame Relay

Unique requirements

Make sure the ISP can meet any unique requirements you may have, such as:

- Dynamic or static IP addressing
- IP address range
- Custom domain name
- Multiple e-mail addresses
- Web site hosting
- E-commerce
- VPN support

Pricing and support

Compare pricing, service, and technical support service among various ISPs.

Endorsements

Consider recommendations from colleagues and reviews in publications. Netopia lists Netopia Certified ISPs on our Web site at **http://www.netopia.com**.

Deciding on an ISP account

Your ISP may offer various Internet access account plans. Typically, these plans vary by usage charges and the number of host IP addresses supplied. Evaluate your networking needs and discuss them with your ISP before deciding on a plan for your network.

Setting up a Netopia R5000 Series account

Check whether your ISP has the Netopia R5000 Series on its list of supported products that have been tested with a particular configuration. If the ISP does not have the Netopia R5000 Series on such a list, describe the Netopia R5000 Series in as much detail as needed, so your ISP account can be optimized. As appropriate, refer your ISP to Netopia's Web site, http://www.netopia.com, for more information.

Obtaining an IP address

Typically, each network computer that requires Internet access requires its own unique IP address. If some or all network computers require simultaneous Internet access, obtain a block of IP host addresses large enough for each computer to have its own address, plus one for the Netopia R5000 Series.

Consider expected growth in your network when deciding on the number of addresses to obtain. Alternatively, you can use the Network Address Translation feature such that you require just one address from your service provider.

Obtaining information from the ISP

After your account is set up, the ISP should send you the IP parameter information that will help you configure the Netopia R5000 Series.

Local LAN IP address information to obtain

Your ISP will need to provide you with the following information:

- The default gateway IP address (same as remote IP address in most cases)
- Local WAN IP address and subnet mask
- Primary and secondary domain name server (DNS) IP addresses
- Domain name (usually the same as the ISP's domain name unless you have registered for your own individual domain name)

Note: The default gateway, WAN address and mask, DNS, and domain name are all obtainable via WAN DHCP, if your ISP supports it.

With Network Address Translation

If you are using Network Address Translation you should obtain the following:

- If you are connecting to a remote site using Network Address Translation on your router, your provider will not define the IP address information on your local LAN. You can define this information based on an IP configuration that may already be in place for the existing network. Alternatively, you can use the default IP address range used by the router, 192.168.1.x.

Without Network Address Translation

If you are not using Network Address Translation, you will need to obtain all of the local LAN IP address information from your ISP.

If you are not using Network Address Translation you should obtain:

- The number of Ethernet IP host addresses available with your account and the first usable IP host address in the address block
- The Ethernet IP address for your Netopia R5000 Series
- The Ethernet IP subnet mask address for your Netopia R5000 Series

Chapter 3

Making the Physical Connections

This section tells you how to make the physical connections to your Netopia R5000 Series Router. This section covers the following topics:

Find a location

When choosing a location for the Netopia Router, consider:

- Available space and ease of installation
- Physical layout of the building and how to best use the physical space available for connecting your Netopia Router to the LAN
- Available wiring and jacks
- Distance from the point of installation to the next device (length of cable or wall wiring)
- Ease of access to the front of the unit for configuration and monitoring
- Ease of access to the back of the unit for checking and changing cables
- Cable length and network size limitations when expanding networks

For small networks, install the Netopia R5000 Series Router near one of the LANs. For large networks, you can install the Netopia R5000 Series Router in a wiring closet or a central network administration site.

What you need

Locate all items that you need for the installation.

Included in your router package are:

- The Netopia R5000 Series Router
- A power adapter and cord with a mini-DIN8 connector
- One RJ-45 Ethernet cable
- One RJ-45 Telco (or Line) cable
- A dual DB-9 and mini-DIN8 to DB-9 console cable (for a PC or a Macintosh)
- An X.21 DTE cable or a V.35 DTE cable (for a Serial model only)
- The Netopia CD containing an Internet browser, Adobe Acrobat Reader for Windows and Macintosh, ZTerm terminal emulator software and NCSA Telnet for Macintosh, this *User's Reference Guide*, and other documentation

You will need:

- A Windows 95 or 98–based PC or a Macintosh computer with Ethernet connectivity for configuring the Netopia R5000 Series Router. This may be built-in Ethernet or an add-on card, with TCP/IP installed and configured. See "Before running SmartStart" on page 5-2.
- A wall outlet wired for a T1 (for the R5300) or DDS (for the R5200) connection or a connection to an external CSU/DSU or modem (for the R5100).

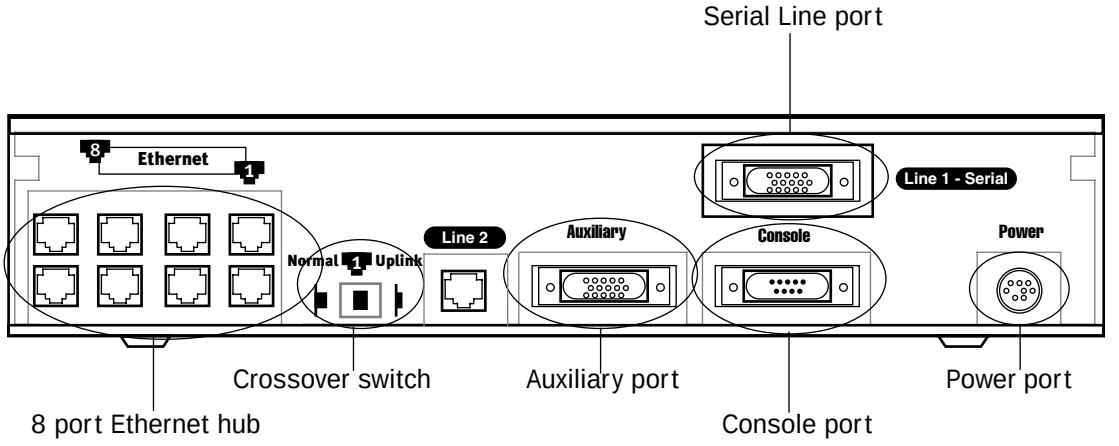
Connect the router

Identify the connectors and switches on the back panel and attach the necessary Netopia Router cables.

R5100 Serial

The figure below displays the back of the Netopia R5100 Serial Router.

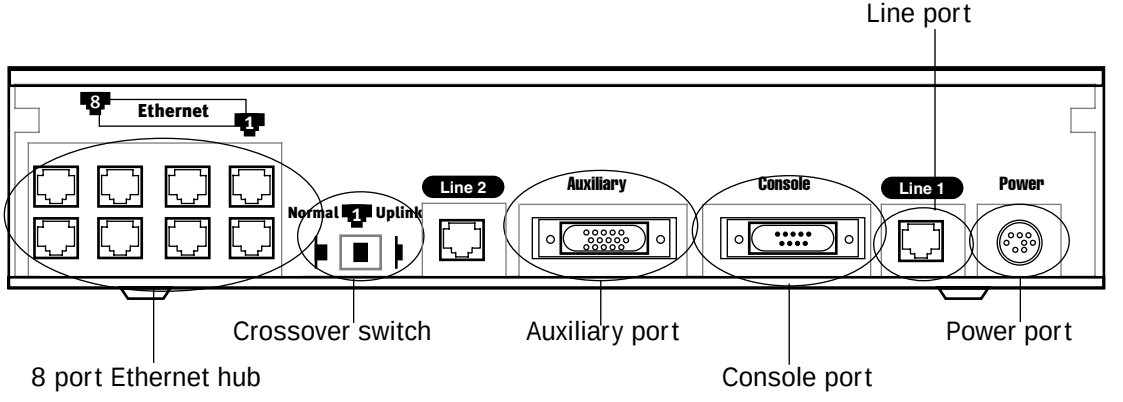
Netopia R5100 back panel



R5200 DDS and R5300 T1

The figure below displays the back of the Netopia R5200 DDS or R5300 T1 Router.

Netopia R5200/5300 back panel



Note: For simplicity, the remainder of this manual uses the figure above to illustrate connections.

Identify the connectors

The following table describes all of the Netopia R5000 Series Router back panel ports.

Port	Description
Power port	A mini-DIN8 power adapter cable connection.
Serial Line 1 port (R5100 Serial router only)	A DB-15 serial port labelled Line 1 - Serial for your external CSU/DSU or modem connection.
Line ports	A telephone-style jack labeled "Line 1" for your T1 or DDS WAN connection. Use the "Line 1" port, NOT "Line 2." The Line port is not used for a Serial connection.
Console port	A DB-9 console port for a direct serial connection to the management console screens. You can use this if you are unable to connect to the console screens using Telnet over the network. See "Connecting a console cable to your router" on page 6-3.
Auxiliary port	An HD-15 auxiliary port for attaching an external modem for remote management or the optional AppleTalk kit.
Crossover switch	A crossover switch with Normal and Uplink positions. If you use Ethernet Port #1 for a direct Ethernet connection between a computer and the router, set the switch to the **Normal** position. If you are connecting the router to an Ethernet hub, use Ethernet port #1 on the router and set the switch to the **Uplink** position.
8-port Ethernet hub	Eight Ethernet jacks. You will use one of these to configure the Netopia R5000 Series Router. For a new installation, use the Ethernet connection. Alternatively, you can use the console connection to run console-based management using a direct serial connection. You can either connect your computer directly to any of the Ethernet ports on the router, or connect both your computer and the router to an existing Ethernet hub on your LAN.

Attach the cables

1. Connect an RJ-45 Ethernet cable to any of the Ethernet ports on the router and the Ethernet port on your computer.
2. **R5100 Serial:** Connect the special DB-15 Serial cable to the Serial Line 1 port and to your external CSU/DSU or modem.
   or
   R5200 DDS or R5300 T1: Connect one end of an RJ-45 Telco cable to the Line 1 port and the other end to your T1 or DDS wall outlet.
3. Connect the mini-DIN8 connector from the power adapter to the power port, and plug the other end into an electrical outlet.

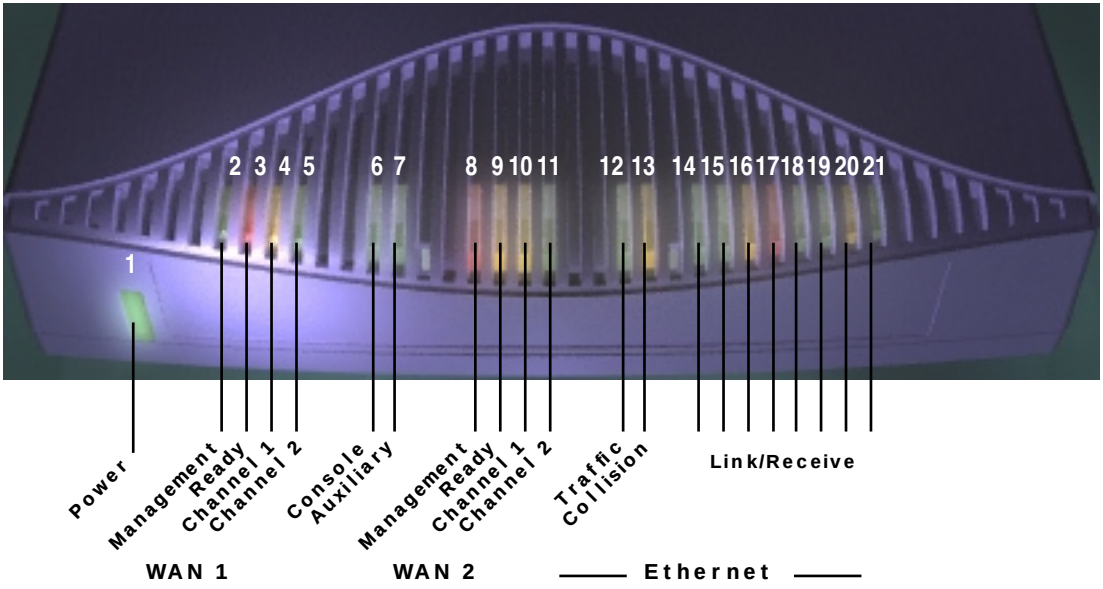
   (If you are connecting the router to an existing Ethernet hub, use Ethernet port #1 on the router and set the crossover switch to the **Uplink** position.)

   You should now have the power adapter plugged in, the Ethernet cable connected between the router and your computer, and either the Serial cable connected to a CSU/DSU or modem (R5100 Serial) or the Line cable connected between the router and the Line wall outlet (R5200 DDS and R5300 T1).

Netopia R5000 Series Router status lights

The figure below represents the Netopia R5000 Series Router status light (LED) panel.

Netopia R5000 Series Router LED front panel



The following table summarizes the meaning of the various LED states and colors:

When this happens...	the LEDs...
The corresponding line passes supervisory traffic between the WAN and the Netopia R5000 Series Router	2 flashes **yellow**.
The WAN interface is operational	3 is **green**.
The line is unavailable	3 flashes **red**.
The WAN has carrier	4 is **green**.
Data is transmitted or received on the WAN	4 flashes **yellow**.
Carrier is asserted	6 and 7 are **green**.
Data is transmitted or received	6 and 7 flash **yellow**.
Data is transmitted or received by the Ethernet controller	12 flashes **yellow**.
The Ethernet interface detects a collision	13 flashes **red**.
Link is detected	14 though 21 are **solid green**.
Data are received on their respective ports	14 though 21 **flash green**.
Note: Channel 2 (#5) and WAN 2 (#8 through #11) are unused, since traffic is carried only on WAN channel 1. Also, Console carrier (6) is ignored if the console is not configured for a remote modem.	

Chapter 4

Connecting to Your Local Area Network

This chapter describes how to physically connect the Netopia R5000 Series to your local area network (LAN). Before you proceed, make sure the Netopia R5000 Series is properly configured. You can customize the router's configuration for your particular LAN requirements using console-based management (see "Console-Based Management" on page 6-1).

This section covers the following topics:

Overview

You can connect the Netopia R5000 Series to an IP or IPX network that uses Ethernet.

If you have purchased the AppleTalk feature expansion kit, you can also connect the router to a LocalTalk network that uses PhoneNET cabling.

Additionally, on the R5200 and R5300 models you can connect an external modem for remote management. See "Adding an external modem" on page 4-4.

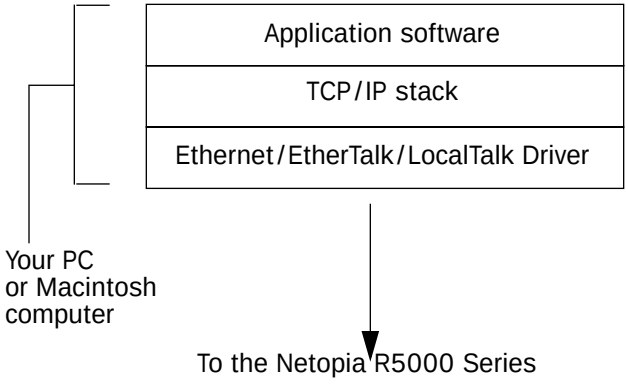
Caution!

Before connecting the Netopia R5000 Series to any AppleTalk LANs that contain other AppleTalk routers, you should read "Routers and seeding" on page 11-3.

See the later sections in this chapter for details on how to connect the Netopia R5000 Series to different types of networks.

Readying computers on your local network

PC and Macintosh computers must have certain components installed before they can communicate through the Netopia R5000 Series. The following illustration shows the minimal requirements for a typical PC or Macintosh computer.



Application software: This is the software you use to send e-mail, browse the World Wide Web, read newsgroups, etc. These applications may require some configuration. Examples include the Eudora e-mail client and the Web browsers Microsoft Internet Explorer and Netscape Navigator.

TCP/IP stack: This is the software that lets your PC or Macintosh computer communicate using Internet protocols. TCP/IP stacks must be configured with some of the same information you used to configure the Netopia R5000 Series. There are a number of TCP/IP stacks available for PC computers. Windows 95, 98, and NT include a built-in TCP/IP stack. See "Configuring TCP/IP on Windows 95, 98, or NT computers" on page 5-6. Macintosh computers use either MacTCP or Open Transport. See "Configuring TCP/IP on Macintosh computers" on page 5-10.

Ethernet: Ethernet hardware and software drivers enable your PC or Macintosh computer to communicate on the LAN.

EtherTalk and LocalTalk: These are AppleTalk protocols used over Ethernet.

Once the Netopia R5000 Series is properly configured and connected to your LAN, PC and Macintosh computers that have their required components in place will be able to connect to the Internet or other remote IP networks.

Connecting to an Ethernet network

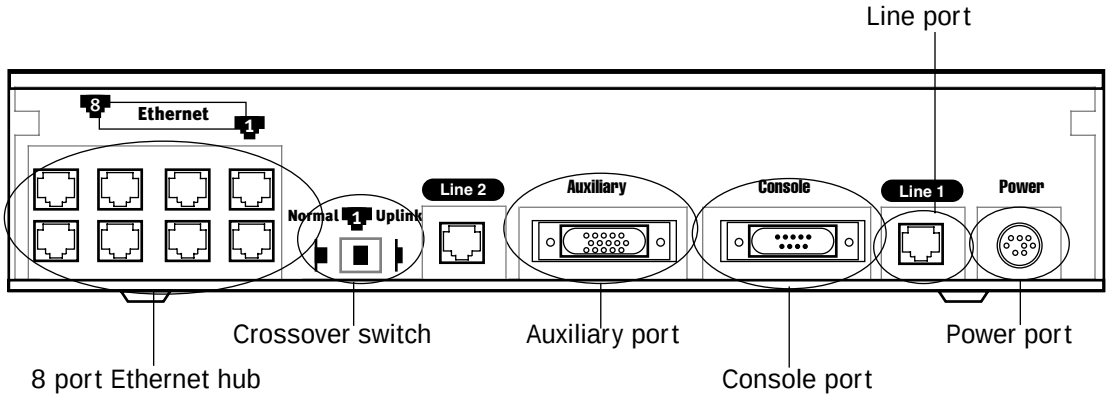
The Netopia R5000 Series supports Ethernet connections through its eight Ethernet ports. The router automatically detects which Ethernet port is in use.

You can connect 10Base-T or 10/100 Ethernet devices to the Netopia R5000 Series Router.

10Base-T

You can connect a standard 10Base-T Ethernet network to the Netopia R5000 Series Router using any of its available Ethernet ports.

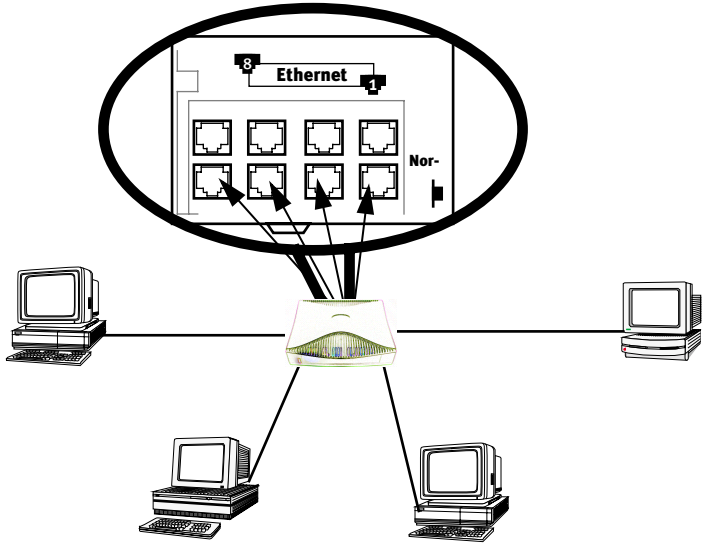
Netopia R5200/5300 back panel



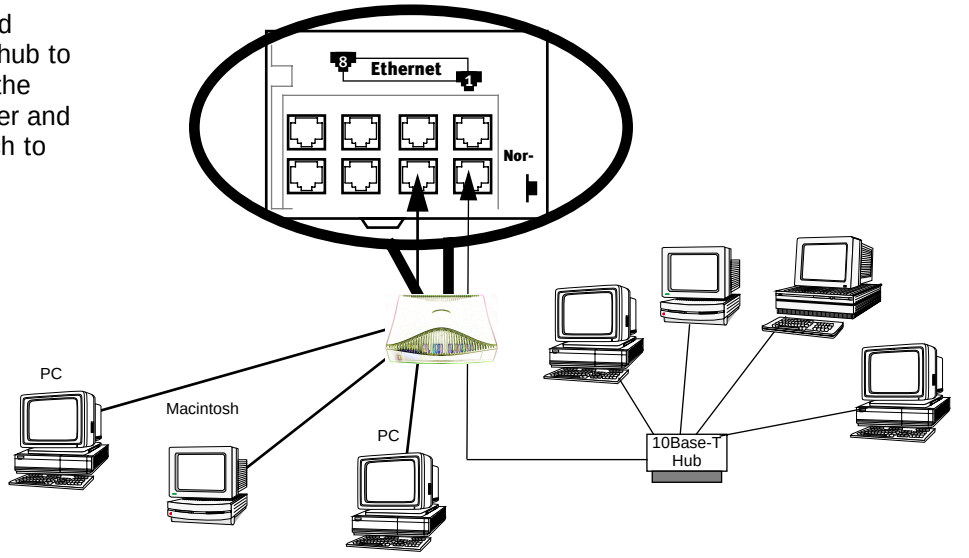
The Netopia R5000 Series in a 10Base-T network

To connect your 10Base-T network to the Netopia R5000 Series through an Ethernet port, use a 10Base-T cable with RJ-45 connectors.

If you have more than eight devices to connect, you can attach additional devices using another 10Base-T hub.



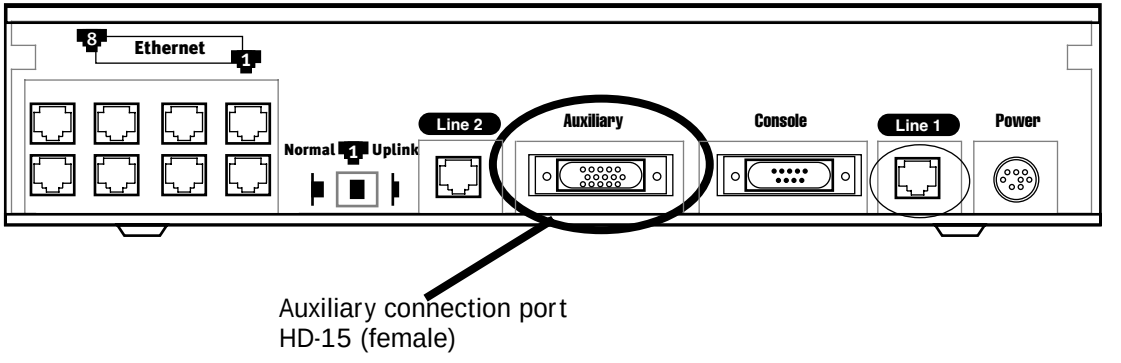
If you add devices connected through a hub, connect the hub to Ethernet port number 1 on the Netopia R5000 Series Router and set the Normal/Uplink switch to Uplink.



Adding an external modem

You may want to add an external modem to your Auxiliary port so that you can manage it even if the Internet connectyion isn't functioning. Obtain the special DB-25 external modem cable (TE6/DB25) either from your reseller or directly from Netopia.

Netopia R5000 Series Auxiliary port for connecting an external modem



By default, the Auxiliary port on your Netopia R5000 Series is enabled for remote console-based management via an external modem. This means that all you have to do is connect your modem to the Auxiliary port and configure the router for any AT command string your modem requires in the **Line Configuration** screens under the **WAN Configuration** menu.

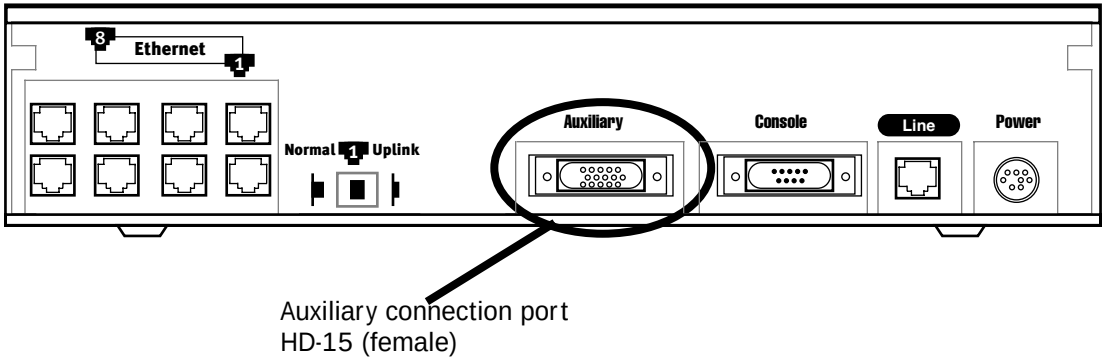
For pinout information on the HD-15 to DB-25 modem cable, see "Pinouts for Auxiliary port modem cable," in Appendix F, "Technical Specifications and Safety Information."

Connecting to a LocalTalk network

If you have purchased the AppleTalk feature expansion kit, you can also connect the router to an AppleTalk network that uses either Ethernet or LocalTalk. Refer to the sheet of optional feature set add-ons in your Netopia R5000 Series documentation folio.

The AppleTalk feature expansion kit includes a special dual RJ-11 PhoneNET connector that attaches to the Auxiliary port on the Netopia R5000 Series.

Netopia R5000 Series Auxiliary port for connecting to LocalTalk



Connect the male HD-15 end of the PhoneNET connector to the Auxiliary port on your Netopia R5000 Series. Connect the other end of the cable to your LocalTalk network. You can use only one connection on the Auxiliary port. You cannot use both the PhoneNET connector and an external modem.

If your LocalTalk network is not based on standard PhoneNET cabling, use a PhoneNET-to-LocalTalk adaptor cable available from Farallon Communications, Inc. (www.farallon.com). Connect the adaptor cable's RJ-11 connector to the AppleTalk cable's PhoneNET connector. Connect the cable's mini-DIN-3 connector to your LocalTalk network.

Be sure to observe Farallon's recommendations governing maximum cable lengths and limits on the number of nodes on a PhoneNET network. The dual RJ-11 PhoneNET connector allows insertion in the LocalTalk daisy chain or at the end. If the device is connected at the end of the daisy chain, you must install the accompanying terminator.

For detailed configuration instructions see "AppleTalk Setup" on page 11-1.

Chapter 5

Setting up your Router with the SmartStart Wizard

Once you've connected your router to your computer and your telecommunications line and installed a web browser, you're ready to run the Netopia SmartStart™ Wizard. The SmartStart Wizard will help you set up the router and share the connection. The SmartStart Wizard walks you through a series of questions and, based on your responses, automatically configures the router for connecting your LAN to the Internet or to your remote corporate network.

The SmartStart Wizard will:

- automatically check your Windows 95, 98, or NT PC's TCP/IP configuration to be sure you can accept a dynamically assigned IP address, and change it for you if it is not set for dynamic addressing
- check the physical connection from your computer to your router without your having to enter an IP address
- assign an IP address to your router

This chapter covers the following topics:

Before running SmartStart

Be sure you have connected the cables and power source as described in Step 1 "Connect the Router" guide contained in your Netopia folio.

Before you launch the SmartStart application, make sure your computer meets the following requirements:

	PC	Macintosh
System software	Windows 95, 98, or NT operating system	MacOS 7.5 or later
Connectivity software	TCP/IP must be installed and properly configured. See "Configuring TCP/IP on Windows 95, 98, or NT computers" on page 5-6	MacTCP or Open Transport TCP/IP must be installed and properly configured. See "Configuring TCP/IP on Macintosh computers" on page 5-10.
Connectivity hardware	Ethernet card (10Base-T)	Either a built-in or third-party Ethernet card (10Base-T)
Browser software	Netscape Communicator™ or Microsoft Internet Explorer, included on the Netopia CD. Required for web-based registration and web-based monitoring.	

Notes:

- The computer running SmartStart must be on the same Ethernet cable segment as the Netopia R5000 Series Router. Repeaters, such as 10Base-T hubs between your computer and the Netopia R5000 Series, are acceptable, but devices such as switches, 10/100 bridges, or other routers are not.
- The Easy setup option in SmartStart for the PC will offer to set your TCP/IP control panel to "Obtain an IP address automatically" if it is not already set this way. This will cause your computer to reboot. If you have a specified IP address configured in the computer, you should make a note of it before running SmartStart, if you do not want to use the dynamic LAN IP addressing features built in to the Netopia Router. You may choose to use the console cable to connect directly to the console-based management. Alternatively, you can restore your computer to its fixed IP address after changing the default LAN IP addressing scheme of the router to match.

Setting up your Router with the SmartStart Wizard

The SmartStart Wizard is tailored for your platform, but it works the same way on either a PC or a Macintosh. Insert the Netopia CD, and in the desktop navigation screen that appears, launch the SmartStart Wizard application.

SmartStart Wizard configuration screens

The screens described in this section are the default screens shipped on the Netopia CD. They derive from two initialization (.ini) files included in the same directory as the SmartStart application file. Your reseller or your ISP may have supplied you with customized versions of these files.

- If you have received a CD or diskette that has been customized by your reseller or ISP, you can run the SmartStart Wizard directly from the CD or diskette and follow the instructions your reseller or ISP provides. This makes your Netopia R5000 Series configuration even easier.
- If you have received only the .ini files from your reseller or ISP, perform the following:
  - Copy the entire directory folder containing the SmartStart Wizard application from the Netopia CD to your hard disk.
  - Copy the customized .ini files to the same directory folder that contains the SmartStart Wizard application, allowing the copy process to overwrite the original .ini files.
  - Run the SmartStart Wizard from your hard disk. You can then follow the instructions your reseller or ISP provides.

The SmartStart Wizard presents a series of screens to guide you through the preliminary configuration of a Netopia R5000 Series. It will then create a connection profile using the information you supply to it.

Welcome screen. The first screen welcomes you to the SmartStart Wizard configuration utility.

Click the Next button after you have responded to the interactive prompts in each screen.

The Help button will display useful information to assist you in responding to the interactive prompts.

Setup options screen. You can choose either Easy or Advanced setup.

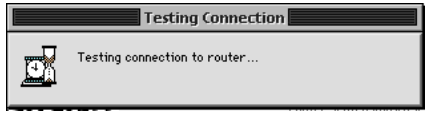
- If you choose Easy, SmartStart automatically uses the preconfigured IP addressing setup built into your router. This is the best choice if you are creating a new network or don't already have an IP addressing scheme on your network.

  If you choose Easy, you will see a "Connection Test screen," like the one shown below while SmartStart checks the connection to your router.

- If you choose Advanced, skip to page 5-5 now. The SmartStart Wizard displays the "Router IP Address screen" on page 5-5. Choose this path to modify your router's IP address to match an existing IP addressing scheme.

Easy option

Connection Test screen. SmartStart tests the connection to the router. While it is testing the connection, a progress indicator screen is displayed and the router's Ethernet LEDs flash.



When the test succeeds, SmartStart indicates success.

If the test fails, the wizard displays an error screen. If the test fails, check the following:

- Check your cable connections. Be sure you have connected the router and the computer properly, using the correct cables. Refer to the Step 1 "Connect the Router" sheet in your Netopia R5000 Series documentation folio.
- Make sure the router is turned on and that there is an Ethernet connection between your computer and the router.
- Check the TCP/IP control panel settings to be sure that automatic IP Addressing (Windows) or DHCP (Macintosh) is selected. If you are using a Windows PC, SmartStart will automatically detect a static IP address and offer to configure the computer for automatic addressing. On a Macintosh computer, you must manually set the TCP/IP Control Panel to DHCP. See "Configuring TCP/IP on Macintosh computers" on page 5-10. If you currently use a static IP address outside the 192.168.1.x network, and want to continue using it, use the Advanced option to assign the router an IP address in your target IP range. See "Advanced option" on page 5-5.
- If all of the above steps fail to resolve the problem, reset the router to its factory default settings and rerun SmartStart. See "Factory defaults" on page 14-7 for instructions.

When the test is successful, SmartStart presents you with the "Additional Configuration screen," shown below.

Additional Configuration screen. If you have a router that has a permanent unswitched connection to your ISP, such as a Netopia R5000 Series Router, the Additional Configuration screen appears.

You may want to do additional configuration to customize your network environment. SmartStart lets you launch your Telnet application by clicking the Telnet button.

Advanced configuration options available via Telnet are explained in "Console-Based Management" on page 6-1.

However, if you need no further configuration options, click Quit. Congratulations! You're finished!

Advanced option

Router IP Address screen. If you selected the Advanced option in the "Setup options screen" on page 5-4, SmartStart asks you to choose between entering the router's current IP address and assigning an IP address to the router.

If the router has already been assigned an IP address, select the first radio button. If you do this, the "Known IP Address screen," appears (shown below.)

If you want to reconfigure the router with a new IP address and subnet mask, select the second radio button. If you do this, the "New IP Address screen" on page 5-6 appears.

When you have done this, click Next.

Known IP Address screen. SmartStart displays a recommended address for the router based on the IP address of the computer.

If you know the router has an IP address different from the default value, enter it now. Otherwise, accept the recommended address.

When you have done this, click Next.

SmartStart tests the connection to your router.

SmartStart then returns you to an "Additional Configuration screen" on page 5-5.

New IP Address screen. If you want to change the router's IP address, you enter the new IP address, the subnet mask, and the router's serial number in this screen. Remember, the serial number is on the bottom of the router. It is also found in your documentation folio.

Note: Forcing a new IP address may turn off the Netopia R5000 Series's IP address serving capabilities, if you assign an IP address and subnet mask outside the router's current IP address serving pool. The Netopia R5000 Series does not allow an invalid address to be served. Use this option with caution.

When you have done this, click Next.

SmartStart forces the new IP address into the router, tests the connection, and then resets the router.

SmartStart then returns you to the "Additional Configuration screen" on page 5-5.

Sharing the Connection

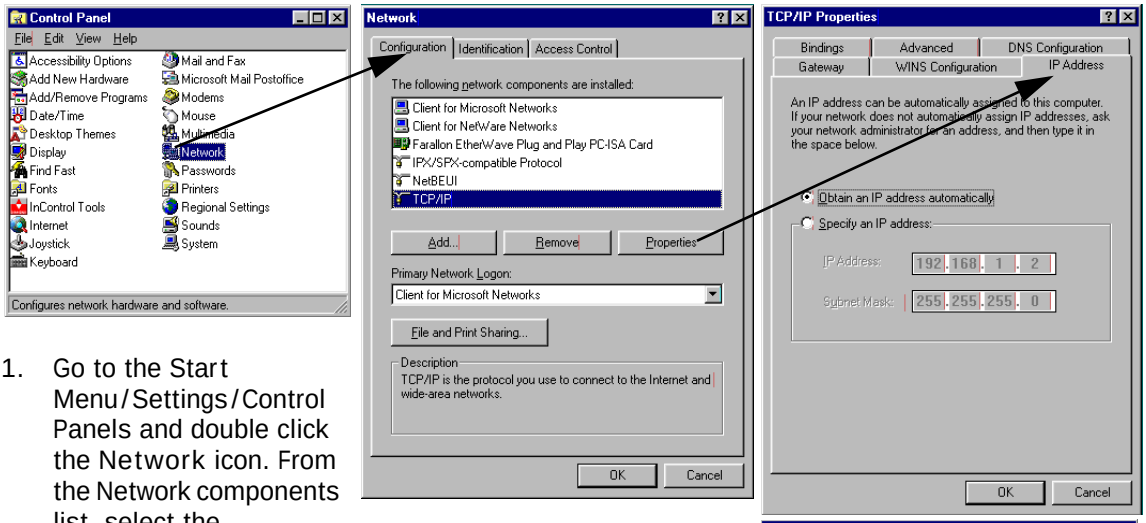
Configuring TCP/IP on Windows 95, 98, or NT computers

Configuring TCP/IP on a Windows computer requires the following:

- An Ethernet card (also known as a network adapter)
- The TCP/IP protocol must be "bound" to the adapter or card

Dynamic configuration (recommended)

If you configure your Netopia R5000 Series using SmartStart, you can accept the dynamic IP address assigned by your router. The Dynamic Host Configuration Protocol (DHCP) server, which enables dynamic addressing, is enabled by default in the router. If your PC is not set for dynamic addressing, SmartStart will offer to do this for you if you select the Easy setup option. In that case, you will have to restart your PC and relaunch SmartStart. If you configure your PC for dynamic addressing in advance, SmartStart need only be launched once. To configure your PC for dynamic addressing do the following:



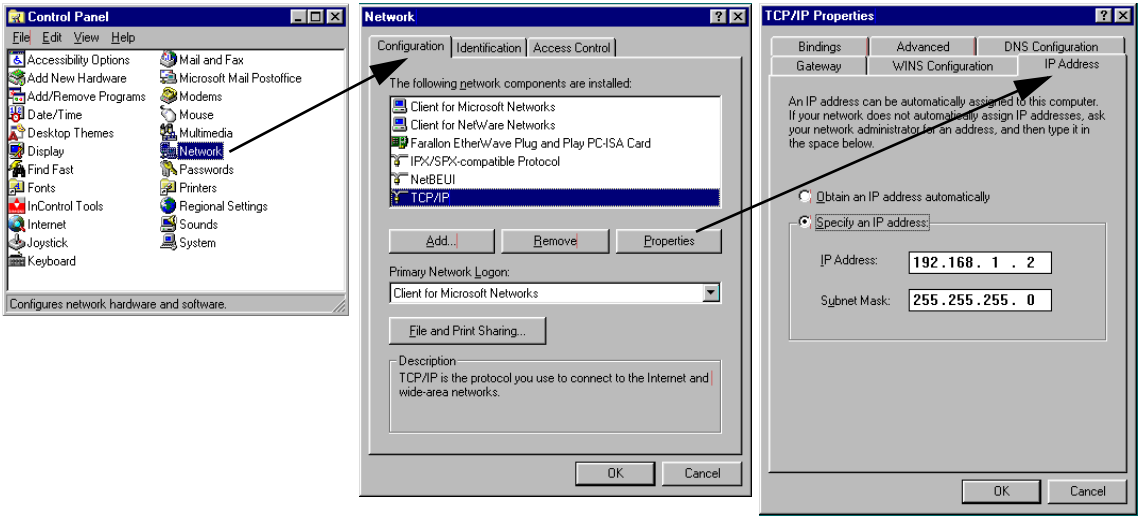
1. Go to the Start Menu/Settings/Control Panels and double click the Network icon. From the Network components list, select the Configuration tab.
2. Select TCP/IP-->Your Network Card. Then select Properties. In the TCP/IP Properties screen (shown here), select the IP Address tab. Click “Obtain an IP Address automatically”.
3. Click on the DNS Configuration tab. Click Disable DNS. DNS will be assigned by the router with DHCP.
4. Click OK in this window and the next window. When prompted, reboot the computer.

Note: You can also use these instructions to configure other computers on your network to accept IP addresses served by the Netopia R5000 Series.

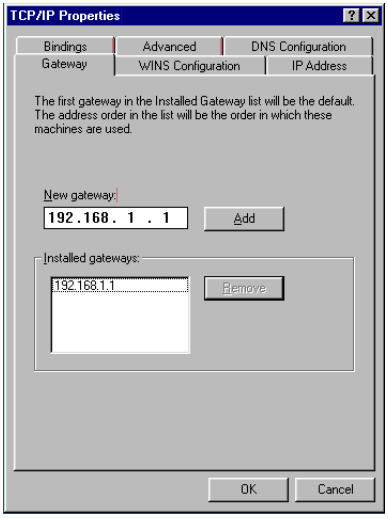
Static configuration (optional)

If you are manually configuring for a fixed or static IP address, perform the following:

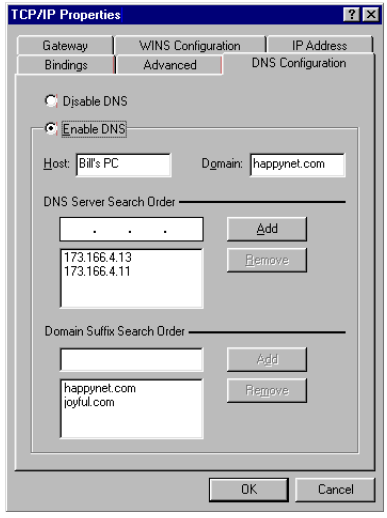
1. Go to Start Menu/Settings/Control Panels and double click the Network icon. From the Network components list, select the Configuration tab.
2. Select TCP/IP-->Your Network Card. Then select Properties. In the TCP/IP Properties screen (shown below), select the IP Address tab. Click "Specify an IP Address."
   Enter the following:
   IP Address: 192.168.1.2
   Subnet Mask: 255.255.255.0, or for 12-user models 255.255.255.240
   This address is an example of one that can be used to configure the router with the Easy option in the SmartStart Wizard. Your ISP or network administrator may ask you to use a different IP address and subnet mask.



3. Click on the Gateway tab (shown below). Under “New gateway,” enter 192.168.1.1. Click Add. This is the Netopia R5000 Series’s pre-assigned IP address.



Click on the DNS Configuration tab. Click Enable DNS. Enter the following information:



Host: Type the name you want to give to this computer.

Domain: Type your domain name. If you don't have a domain name, type your ISP's domain name; for example, netopia.com.

DNS Server Search Order: Type the primary DNS IP address given to you by your ISP. Click Add. Repeat this process for the secondary DNS.

Domain Suffix Search Order: Enter the same domain name you entered above.

4. Click OK in this window and the next window. When prompted, reboot the computer.

Note: You can also use these instructions to configure other computers on your network with manual or static IP addresses. Be sure each computer on your network has its own IP address.

Configuring TCP/IP on Macintosh computers

The following is a quick guide to configuring TCP/IP for MacOS computers. Configuring TCP/IP in a Macintosh computer requires the following:

- You must have either Open Transport or Classic Networking (MacTCP) installed.

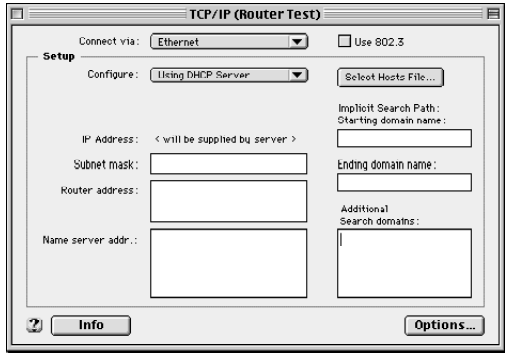
  Note: If you want to use the Dynamic Host Configuration Protocol (DHCP) server built into your Netopia R5000 Series to assign IP addresses to your Macintoshes, you must be running Open Transport, standard in MacOS 8 and optional in earlier system versions. You can have your Netopia R5000 Series dynamically assign IP addresses using MacTCP; however, to do so requires that the optional AppleTalk kit be installed which can only be done after the router is configured.

- You must have built-in Ethernet or a third-party Ethernet card and its associated drivers installed in your Macintosh.

Dynamic configuration (recommended)

If you configure your Netopia R5000 Series using SmartStart, you can accept the dynamic IP address assigned by your router. The Dynamic Host Configuration Protocol (DHCP), which enables dynamic addressing, is enabled by default in the router. To configure your Macintosh computer for dynamic addressing do the following:

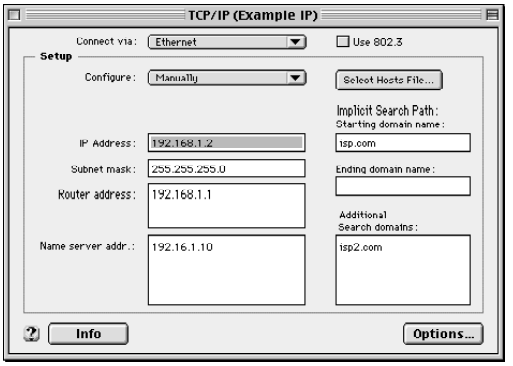
1. Go to the Apple menu. Select Control Panels and then TCP/IP.
2. With the TCP/IP window open, go to the Edit menu and select User Mode. Choose Basic and click OK.
3. In the TCP/IP window, select "Connect via: Ethernet" and "Configure: Using DHCP Server."



Note: You can also use these instructions to configure other computers on your network to accept IP addresses served by the Netopia R5000 Series.

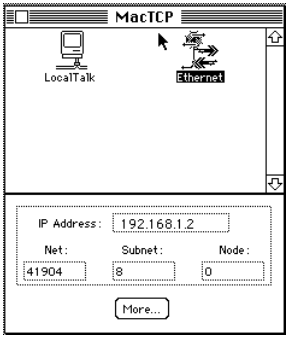
Static configuration (optional)

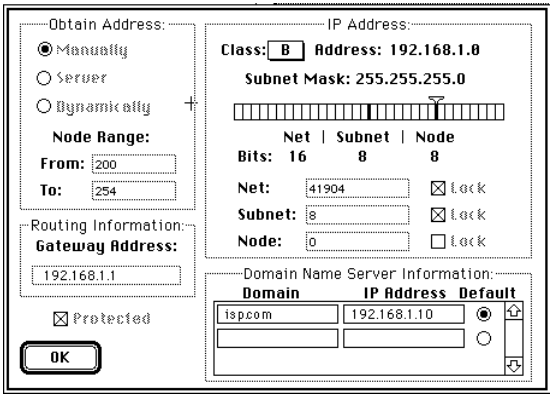
If you are manually configuring for a fixed or static IP address, perform the following:



1. Go to the Apple menu. Select Control Panels and then TCP/IP or MacTCP.
2. With the TCP/IP window open, go to the Edit menu and select User Mode. Choose Advanced and click OK.

   Or, in the MacTCP window, select Ethernet and click the More button.





3. In the TCP/IP window or in the MacTCP/More window, select or type information into the fields as shown in the following table.

Option:	Select/Type:
Connect via:	Ethernet
Configure:	Manually
IP Address:	192.168.1.2
Subnet mask:	255.255.255.0, or for 12-user models 255.255.255.240
Router or Gateway address:	192.168.1.1
Name server address:	Enter the primary and secondary name server addresses given to you by your ISP
Implicit Search Path: Starting domain name:	Enter your domain name; if you do not have a domain name, enter the domain name of your ISP

4. Close the TCP/IP or MacTCP control panel and save the settings.
5. If you are using MacTCP, you must restart the computer. If you are using Open Transport, you do not need to restart.

Note: You can also use these instructions to configure other computers on your network with manual or static IP addresses. Be sure each computer on your network has its own IP address.

Dynamic configuration using MacIP (optional)

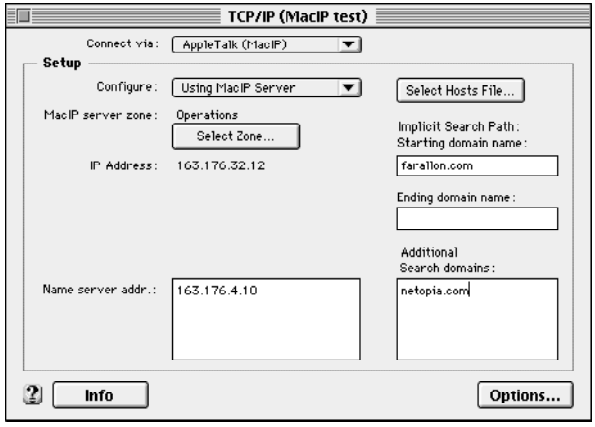
If you want to use MacIP to dynamically assign IP addresses to the Macintosh computers on your network you must install the optional AppleTalk feature set kit.

Note: You cannot use MacIP dynamic configuration to configure your Netopia R5000 Series Router because you must first configure the router in order to enable AppleTalk.

Once the AppleTalk kit is installed, you can configure your Macintoshes for MacIP. To configure dynamically using MacIP, perform the following:

Using Open Transport TCP/IP

1. Go to the Apple menu. Select **Control Panels** and then **TCP/IP**.
2. With the TCP/IP window open, go to the Edit menu and select **User Mode**. Choose **Advanced** and click **OK**.



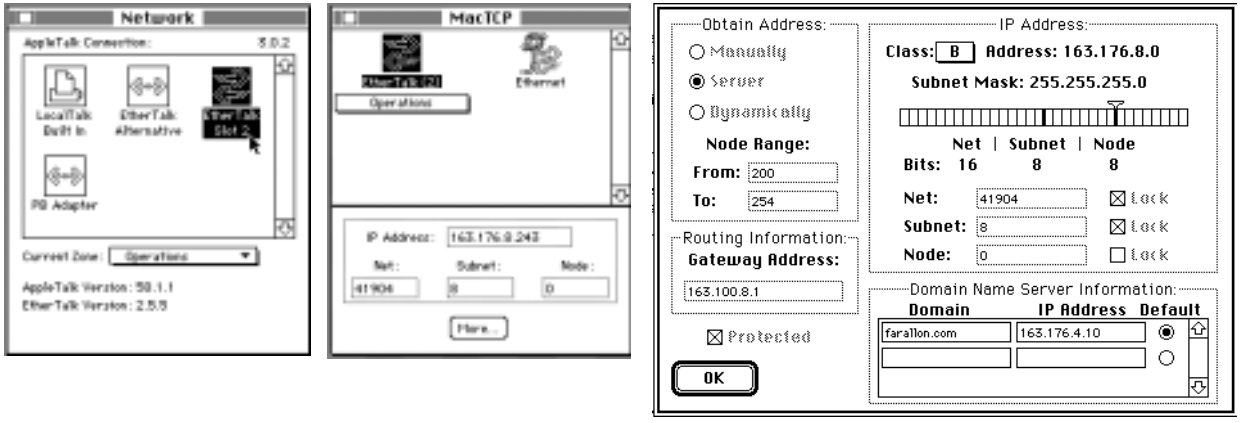
3. In the TCP/IP window, select or type information into the fields as shown in the following table.

TCP/IP Option:	Select / Type:
Connect via:	AppleTalk (MacIP)
Configure:	Using MacIP server
MacIP Server zone:	(select available zone)
Name server address:	Enter the primary and secondary name server addresses given to you by your ISP
Implicit Search Path: Starting domain name:	Enter your domain name; if you do not have a domain name, enter the domain name of your ISP

4. Close the TCP/IP control panel and save the settings.

Using Classic Networking (MacTCP)

1. Go to the Apple Menu. Select **Control Panels** and then **Network**.
2. In the Network window, select **EtherTalk**.



3. Go back to the Apple menu. Select **Control Panels** and then **MacTCP**.
4. Select **EtherTalk**.

   From the pull-down menu under EtherTalk, select an available zone; then click the **More** button.

   In the MacTCP/More window select the **Server** radio button. If necessary, fill in the Domain Name Server Information given to you by your administrator.
5. Restart the computer.

Note: More information about configuring your Macintosh computer for TCP/IP connectivity through a Netopia R5000 Series can be found in Technote NIR_026, “Open Transport and Netopia Routers,” located on the Netopia Web site.

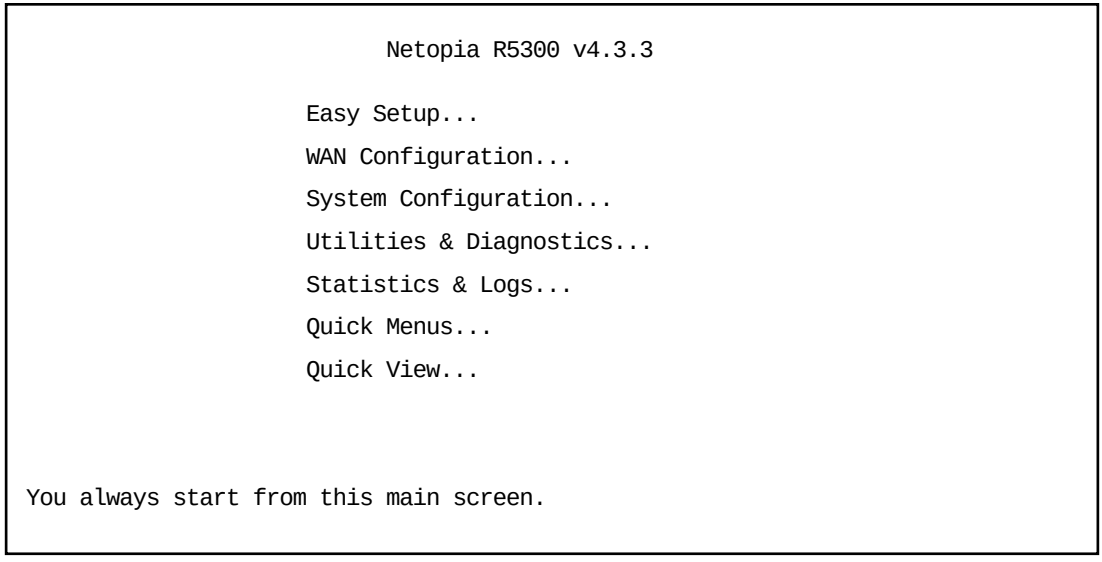
Chapter 6

Console-Based Management

Console-based management is a menu-driven interface for the capabilities built into the Netopia R5000 Series routers. Console-based management provides access to the full range of features that the router supports. You can customize these features for your individual setup. This chapter describes how to access the console-based management screens.

This section covers the following topics:

Console-based management screens contain seven entry points to the Netopia Router configuration and monitoring features. The entry points are displayed in the Main Menu shown below:



- The **Easy Setup** menus display and permit changing the values contained in the default connection profile. Experienced users can use Easy Setup to initially configure the router directly through a console session.

  Easy Setup menus contain up to five descendant screens for viewing or altering these values. The number of screens depends on whether you have optional features installed.

- The **WAN Configuration** menu displays and permits changing your connection profile(s) and default profile, creating or deleting additional connection profiles, and configuring or reconfiguring the manner in which you

may be using the router to connect to more than one service provider or remote site.

- The **System Configuration** menus display and permit changing:
  - Network protocols setup. See "IP Setup and Network Address Translation" on page 9-1, "IPX Setup" on page 10-1, and "AppleTalk Setup" on page 11-1.
  - Filter sets (firewalls). See "Security" on page 13-1.
  - IP address serving. See "IP address serving" on page 9-22.
  - Date and time. See "Date and time" on page 8-34.
  - Console configuration. See "Connecting a console cable to your router" on page 6-3.
  - SNMP (Simple Network Management Protocol). See "SNMP" on page 12-13.
  - Security. See "Security" on page 13-1.
  - Upgrade feature set. See "Upgrade feature set" on page 8-36.
- The **Utilities & Diagnostics** menus provide a selection of seven tools for monitoring and diagnosing the router's behavior, as well as for updating the firmware and rebooting the system. See "Utilities and Diagnostics" on page 14-1 for detailed information.
- The **Statistics & Logs** menus display nine sets of tables and device logs that show information about your router, your network, and their history. See "Statistics & Logs" on page 12-4 for detailed information.
- The **Quick Menus** screen is a shortcut entry point to 22 of the most commonly used configuration menus that are accessed through the other menu entry points.
- The **Quick View** menu displays at a glance current real-time operating information about your router. See "Quick View status overview" on page 12-1 for detailed information.

Connecting through a Telnet session

Features of the Netopia R5000 Series can be configured through the console screens. If you initially use the SmartStart Wizard, the application will automatically connect you to the console-based management screens via Telnet.

Before you can access the console screens through Telnet, you must have:

- A network connection locally to the router or IP access to the router.

  Note: Alternatively, you can have a direct serial console cable connection using the provided console cable for your platform (PC or Macintosh) and the Console port on the back of the router. For more information on attaching the console cable, see "Connecting a console cable to your router" on page 6-3.
- Telnet software installed on the computer you will use to configure the router

Configuring Telnet software

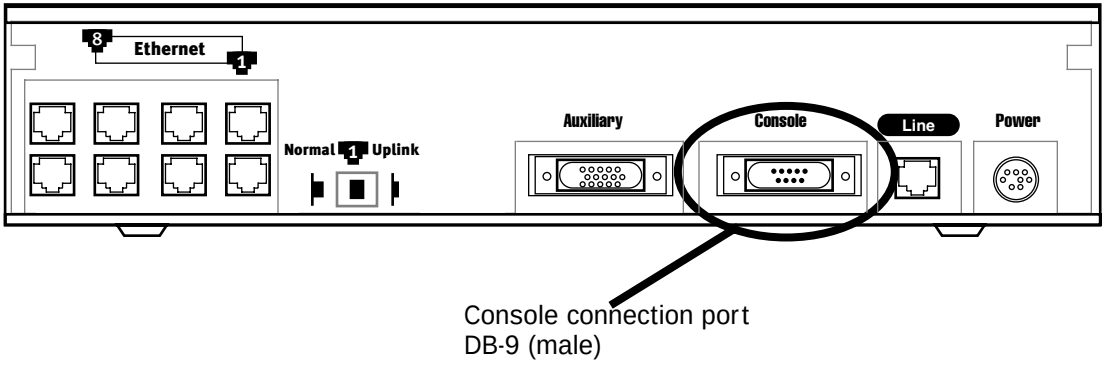
If you are configuring your router using a Telnet session, your computer must be running a Telnet software program.

- If you connect a PC with Microsoft Windows, you can use a Windows Telnet application or simply run Telnet from the Start menu.
- If you connect a Macintosh computer, you can use the NCSA Telnet program supplied on the Netopia R5000 Series CD. You install NCSA Telnet by simply dragging the application from the CD to your hard disk.

Connecting a console cable to your router

You can perform all of the system configuration activities for your Netopia R5000 Series through a local serial console connection using terminal emulation software, such as HyperTerminal provided with Windows 95 on the PC, or ZTerm, included on the Netopia CD, for Macintosh computers.

The Netopia R5000 Series back panel has a connector labeled “Console” for attaching the Router to either a PC or Macintosh computer via the serial port on the computer. (On a Macintosh computer, the serial port is called the Modem port or Printer port.) This connection lets you use the computer to configure and monitor the Netopia R5000 Series via the console screens.



To connect the Netopia R5000 Series to your computer for serial console communication, use the supplied dual console cable connector end appropriate to your platform:

- One DB-9 connector end attaches to a PC.
- The mini-DIN8 connector end attaches to a Macintosh computer.
- The DB-9 end of the Console cable attaches to the Netopia R5000 Series’s Console port.
- If you connect a PC with Microsoft Windows 95 or NT, you can use the HyperTerminal application bundled with the operating system.
- If you connect a Macintosh computer, you can use the ZTerm terminal emulation program on the supplied Netopia R5000 Series CD.

Launch your terminal emulation software and configure the communications software for the values shown in the table below. These are the default communication parameters that the Netopia R5000 Series uses.

Parameter	Suggested Value
Terminal type	**PC**: ANSI-BBS **Mac**: ANSI, VT-100, or VT-200
Data bits	8
Parity	None
Stop bits	1
Speed	57600 bits per second *
Flow Control	None
*** Note:** The router firmware contains an autobaud detection feature. If you are at any screen on the serial console, you can change your baud rate and press Return (HyperTerminal for the PC requires a disconnect). The new baud rate is displayed at the bottom of the screen.	

Navigating through the console screens

Use your keyboard to navigate the Netopia R5000 Series's configuration screens, enter and edit information, and make choices. The following table lists the keys to use to navigate through the console screens.

To...	Use These Keys...
Move through selectable items in a screen or pop-up menu	Up, Down, Left, and Right Arrow
Set a change to a selected item or open a pop-up menu of options for a selected item like entering an upgrade key	Return or Enter
Change a toggle value (Yes/No, On/Off)	Tab
Restore an entry or toggle value to its previous value	Esc
Move one item up	Up arrow or Control + A
Move one item down	Down arrow or Control + Z
Display a dump of the device event log	Control + E
Display a dump of the WAN event log	Control + F
Refresh the screen	Control + L
Go to topmost selectable item	<
Go to bottom right selectable item	>

Chapter 7

Easy Setup

This chapter describes how to use the Easy Setup console screens on your Netopia R5000 Series Router. After completing the Easy Setup console screens, your router will be ready to connect to the Internet or another remote site.

Easy Setup console screens

Using four Easy Setup console screens, you can:

- Modify a connection profile for your router for the connection to your ISP or remote location
- Set up IP addresses and IP address serving
- Password–protect configuration access to your Netopia R5000 Series Router

Accessing the Easy Setup console screens

To access the console screens, Telnet to the Netopia Router over your Ethernet network or physically connect with a serial console cable and access the Netopia Router with a terminal emulation program. See “Connecting through a Telnet session” on page 6-2 or “Connecting a console cable to your router” on page 6-3.

Note: Before continuing, make sure you have the information that your telephone service provider, ISP, or network administrator has given you for configuring the Netopia Router.

The Netopia Router’s first console screen, Main Menu, appears in the terminal emulation window of the attached PC or Macintosh computer when:

- The Netopia Router is turned on
- The computer is connected to the Netopia Router
- Telnet or the terminal emulation software is running and configured correctly

Screen differences

Netopia R5000 Series Router models offering different feature sets will have variations in the fields on certain screens. Your own Easy Setup screens may look slightly different from those illustrated in this chapter.

A screen similar to the following Main Menu appears:

```
                        Netopia R5300 v4.3.3

                    Easy Setup...
                    WAN Configuration...
                    System Configuration...
                    Utilities & Diagnostics...
                    Statistics & Logs...
                    Quick Menus...
                    Quick View...



Return/Enter goes to Easy Setup -- minimal configuration.
You always start from this main screen.
```

If you do not see the Main Menu, verify that:

- The computer used to view the console screen has its serial port connected to the Netopia R5000 Series's Console port or an Ethernet connection to one of its Ethernet ports. See "Connecting a console cable to your router" on page 6-3 or "Connecting through a Telnet session" on page 6-2.
- Telnet or the terminal emulation software is configured for the recommended values.
- If you are connecting via the Console port, your computer's serial port is not being used by another device, such as an internal modem, or an application. Turn off all other programs (other than your terminal emulation program) that may be interfering with your access to the port.
- You have entered the correct password, if necessary. Your Netopia R5000 Series's console access may be password protected from a previous configuration. See your system administrator to obtain the password.

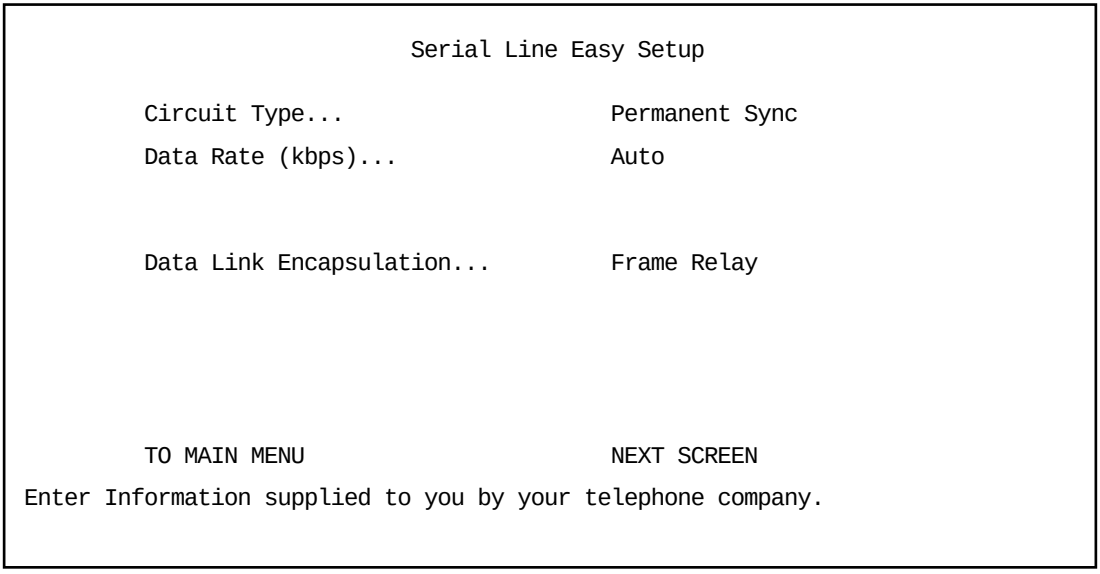
  See Appendix A, "Troubleshooting," for more suggestions.

Select the first item on the Main Menu list, **Easy Setup**. Press Return to bring up the Line Configuration menu screen.

- The Serial Line Configuration screen is described on page 7-3.
- The T1 Line Configuration screen is described on page 7-4.
- The DDS Line Configuration screen is described on page 7-5.

The Serial Line Easy Setup configuration screen

The Serial Line Easy Setup screen appears.



1. Select **Circuit Type** and press Return. From the pop-up menu, select your circuit type: Permanent Sync (the default) or Switched Async.

   If you selected Permanent Sync (the default) proceed to Step 2.

   If you selected Switched Async, the Data Rate defaults to 57.6 for a high speed modem. You can select other speeds, from 19.2 to 230.4 from the pop-up menu. Two additional fields are displayed: **Modem Initialization String** and **Modem Dialing Prefix** allow you to set modem parameters.

2. Select **Data Rate (kbps)** and press Return. From the pop-up menu, select a fixed data rate for your digital line or select **Auto**. The Auto setting allows your Netopia Router to determine the data rate of your serial line at the time of circuit activation. Press Return.

3. Select **Data Link Encapsulation** and highlight the method of encapsulation that you want to use from the pop-up menu. The choices offered are PPP, HDLC, and Frame Relay. The default setting is Frame Relay. For an asynchronous modem, the only encapsulation is PPP. Press Return.

4. Select **NEXT SCREEN** and press Return. The Easy Setup Profile screen appears. See page 7-6.

The T1 Line configuration screen

The T1 Line Configuration screen appears.

```
                          T1 Line Configuration

        Line Encoding...                    B8ZS

        Framing Mode...                     ESF

        Number of DS0 Channels:             1
        First DS0 Channel:                  1



        Channel Data Rate...                Nx64k

        Data Link Encapsulation...          Frame Relay

        TO MAIN MENU                        NEXT SCREEN

Enter Information supplied to you by your telephone company.
```

1. Select **Line Encoding** and press Return. From the pop-up menu, highlight the encoding your telephone service provider uses: **B8Zs** or **AMI**. The default setting is B8Zs. Press Return.
2. Select **Framing Mode** and press Return. From the pop-up menu, highlight either **ESF** or **D4**, depending on the framing mode that your telephone service provider advises you to use. The default setting is ESF. Press Return.
3. Select **Number of DS0 Channels** and enter the number of DS0 channels that you and your telephone service provider have determined are necessary for your T1 line. The default setting for DS0 Channels is 1 (one). Press Return.

   Note: Each DS0 channel represents a 56k or 64k increment in bandwidth. Selecting a number less than the maximum specifies a fractional-T1 interface. You can have a maximum of 24 DS0 channels.
4. Select **First DS0 Channel** and enter the number of the first active DS0 channel you will be using. The default setting is 1 (one). Press Return.

   Note: You can change the First DS0 Channel number, which has a valid range from one to the maximum number minus the number of active channels. If the number of active DS0 channels is 24 (maximum), **First DS0 Channel** is hidden.

   If you specify a number of DS0 channels less than the maximum, a Contiguous Channels item appears. For fractional-T1, you can specify whether the DS0 channels are contiguous or alternating by toggling **Contiguous Channels** to **Yes** or **No**.
5. Select **Channel Data Rate** and highlight the data rate that your service provider has designated your channel to connect at. The channel data rate choices are Nx56k or Nx64k. The default is Nx64k. Press Return.

6. Select **Data Link Encapsulation** and highlight the method of encapsulation that you want to use from the pop-up menu. The choices offered are PPP, HDLC, and Frame Relay. The default setting is Frame Relay. Press Return.
7. Select **NEXT SCREEN** and press Return. The Easy Setup Profile screen appears. See page 7-6.

The DDS Line configuration screen

The DDS Line Configuration screen appears.

```
                          DDS Line Configuration


         Data Rate (kbps)...               Automatic

         Data Link Encapsulation...        PPP









         TO MAIN MENU                      NEXT SCREEN
Enter Information supplied to you by your telephone company.
```

1. Select **Data Rate** and press Return. From the pop-up menu, highlight the data rate that you want your DDS/ADN line connection to transmit at. The data rate choices are **Automatic** (the default), **56 kbps,** and **64 kbps**. Press Return.

   Note: As noted above, DDS/ADN Netopia Routers may run 56 kbps or 64 kbps data rates on permanent circuits. If you accept the default, **Automatic**, the router will hunt between modes until it can determine what the telephone company has provisioned your DDS/ADN line for.
2. Select **Data Link Encapsulation** and highlight the method of encapsulation that you want to use from the pop-up menu. The choices offered are PPP, HDLC, and Frame Relay. The default setting is PPP. Press Return.
3. Select **NEXT SCREEN** and press Return. The Easy Setup Profile screen appears. See page 7-6.

Easy Setup Profile screen

The Easy Setup Profile screen appears.

```
                Connection Profile 1: Easy Setup Profile

        Connection Profile Name:          Easy Setup Profile


        Address Translation Enabled:      Yes
        IP Addressing...                  Unnumbered


        Remote IP Address:                127.0.0.2
        Remote IP Mask:                   255.255.255.255

        Frame Relay Management Type...    ANSI (Annex D)


        PREVIOUS SCREEN                   NEXT SCREEN
Enter basic information about your WAN connection with this screen.
```

The Easy Setup Profile screen is where you configure the parameters that control the Netopia R5000 Series Router's connection to a specific remote destination, usually your ISP or a corporate site.

On a Netopia R5000 Series Router you can add up to 15 more connection profiles, for a total of 16, although you can only use one at a time.

1. To enable address translation, toggle **Address Translation Enabled** to **Yes** (the default). For more information on Network Address Translation, see Chapter 9, "IP Setup and Network Address Translation," on page 9-1.
2. You can toggle **IP Addressing** to either Unnumbered (the default) or Numbered.
3. Select the **Local WAN IP Address** field. The default address is 0.0.0.0, which allows for dynamic addressing, when your ISP assigns an address each time you connect. However, you may enter another specific address if you want to use static addressing. In that case, enter the local WAN address your ISP gave you.

   When using numbered interfaces, the Netopia Router will use its local WAN IP address and subnet mask to send packets to the remote router. Both routers have WAN IP addresses and subnet masks associated with the connection.

   When using unnumbered interfaces, the Netopia Router will use either its local Ethernet IP address or its NAT address (if so configured) and subnet mask to send packets to the remote router. Neither router has a WAN IP address or subnet mask associated with this connection.
4. If you chose Frame Relay as your datalink encapsulation method, select **Frame Relay Management Type** and from the pop-up menu choose ANSI (Annex D), CCITT (Annex A), LMI, or None. ANSI (Annex D) is the default.

If you chose PPP as your datalink encapsulation method, select **PPP Authentication** and from the pop-up menu choose: None (the default), PAP, CHAP, PAP-TOKEN, or CACHE-TOKEN. Selecting any authentication method other than the default None will display fields for you to enter your authentication information, such as User Name and Password.

5. Select **NEXT SCREEN** and press Return. The IP Easy Setup screen appears.

Note: For more Easy Setup options, see the next section. For more Frame Relay configuration options see "Configuring Frame Relay" on page 8-6.

IP Easy Setup

The IP Easy Setup screen is where you enter information about your Netopia Router's:

- Ethernet IP address
- Ethernet Subnet mask
- Domain Name
- Domain Name Server IP address
- Default gateway IP address

Consult with your network administrator to obtain the information you will need. For more information about setting up IP, see "IP Setup and Network Address Translation" on page 9-1.

```
                          IP Easy Setup

        Ethernet IP Address:              192.168.1.1
        Ethernet Subnet Mask:             255.255.255.0

        Domain Name:
        Primary Domain Name Server:       0.0.0.0


        Default IP Gateway:               0.0.0.0

        IP Address Serving:               On

        Number of Client IP Addresses:    100
        1st Client Address:               192.168.1.100



        PREVIOUS SCREEN                   NEXT SCREEN

Enter an IP address in decimal and dot form (xxx.xxx.xxx.xxx).
Set up the basic IP & IPX attributes of your Netopia in this screen.
```

1. Select **Ethernet IP Address** and enter the first IP address from the IP address range your ISP has given you. This will be the Netopia Router's IP address.

   If Network Address Translation is enabled in the Easy Setup connection profile, the Ethernet IP Address defaults to an address within a range reserved by the Internet address administration authority for use within private networks, 192.168.1.1.

Because this is a private network address, it should never be directly connected to the Internet. Using NAT for all your connection profiles will ensure this restriction. See "IP Setup and Network Address Translation" on page 9-1 of this guide for more information.

2. Select **Ethernet Subnet Mask** and enter the subnet mask your ISP has given you. The Ethernet Subnet Mask defaults to a standard class mask derived from the class of the Ethernet IP address you entered in the previous step.
3. Select **Domain Name** and enter the domain name your ISP has given you.
4. Select **Primary Domain Name Server** and enter the IP address your ISP has given you. An alternate or **Secondary Domain Name Server** field will appear, where you can enter a secondary DNS IP address if your ISP has given you one.
5. If you do not enter a **Default IP Gateway** value, the router defaults to the remote IP address you entered in the Easy Setup connection profile. If the Netopia Router does not recognize the destination of any IP traffic, it forwards that traffic to this gateway.

   Do not confuse the remote IP address and the Default IP Gateway's address with the block of local IP addresses you receive from your ISP. You use the local IP addresses for the Netopia R5000 Series's Ethernet port and for IP clients on your local network. The remote IP address and the default gateway's IP address should point to your ISP's router.

Easy Setup Security Configuration

The Easy Setup Security Configuration screen lets you password-protect your Netopia R5000 Series. Input your **Write Access Name** and **Write Access Password** with names or numbers totaling up to eleven digits.

If you password protect the console screens, you will be prompted to enter the name and password you have specified every time you log in to the console screens. Do not forget your name and password. If you do, you will be unable to access any of the configuration screens.

```
                    Easy Setup Security Configuration

It is strongly suggested that you password-protect configuration access to your
Netopia. By entering a Name and Password pair here, access via serial,
Telnet, SNMP and Web Server will be password-protected.

Be sure to remember what you have typed here, because you will be prompted for
it each time you configure this Netopia.

You can remove an existing Name and Password by clearing both fields below.

         Write Access Name:

         Write Access Password:



         PREVIOUS SCREEN       TO MAIN MENU      RESTART DEVICE

Configure a Configuration Access Name and Password here.
```

The final step in configuring the Easy Setup console screens is to restart the Netopia R5000 Series, so that the configuration settings take effect.

1. Select **RESTART DEVICE**. A prompt asks you to confirm your choice.
2. Select **CONTINUE** to restart the Netopia Router and have your selections take effect.

Additional security features are available. See "Security" on page 13-1.

Note: You can also restart the system at any time by using the Restart System utility (see "Restarting the system" on page 14-13) or by turning the Netopia Router off and on with the power switch.

Easy Setup is now complete.

Part II: Advanced Configuration

Chapter 8

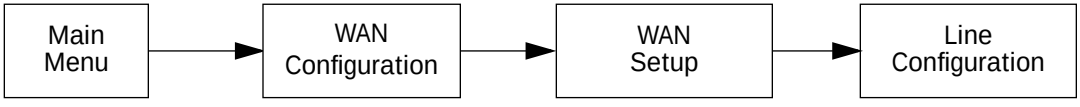
WAN and System Configuration

This chapter describes how to use the console-based management screens to access and configure advanced features of your Netopia R5000 Series Router. You can customize these features for your individual setup. These menus provide a powerful method for experienced users to set up their router's connection profiles and system configuration.

This section covers the following topics:

WAN configuration

To configure your Wide Area Network (WAN) connection, navigate to the WAN Configuration screen from the Main Menu and select **WAN Configuration**, then **Line Configuration**.

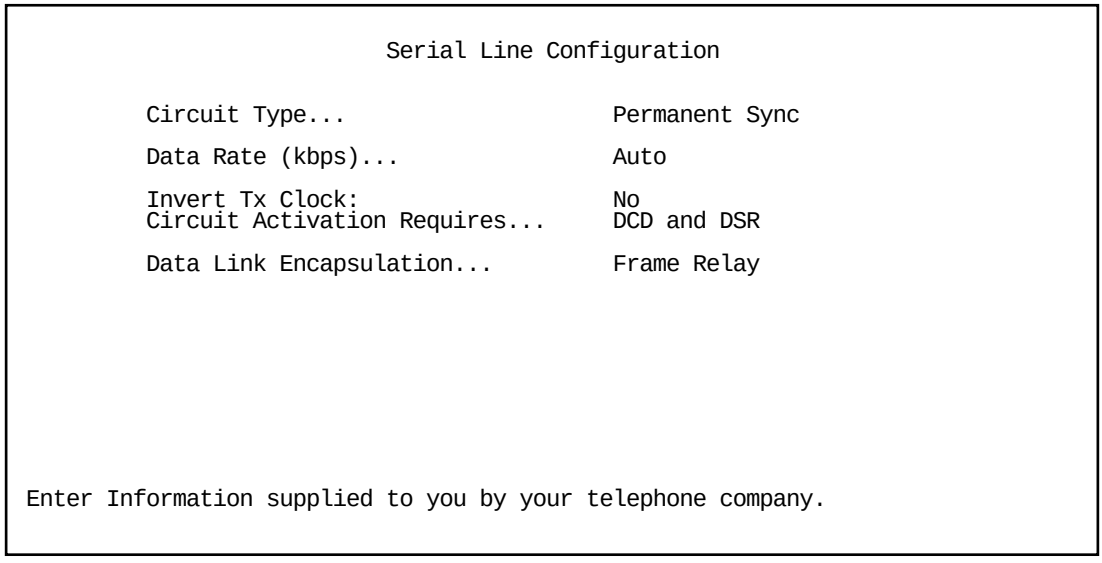


The following sections describe the Line Configuration screen in the WAN Setup menu for an R5100 SA/Serial, R5200 DDS, and R5300 T1 Netopia Router model with PPP, Cisco-HDLC, or Frame Relay data link encapsulation enabled.

- The Serial Line Configuration screen appears for R5100 SA/Serial models (with an external CSU/DSU connection). See page 8-2.
- The DDS Line Configuration screen appears for R5200 DDS models (with an internal CSU/DSU connection). See page 8-3.
- The T1 Line Configuration screen appears for R5300 T1 models (with an internal CSU/DSU connection). See page 8-4.

Line configuration for a Serial line

The Serial Line Configuration screen is where you enter the configuration parameters for your leased line, in order for the Netopia Router to communicate with the physical connection.



1. Select **Circuit Type** and press Return. From the pop-up menu, select your circuit type: Permanent Sync (the default) or Switched Async.
2. Select **Data Rate (kbps)** and press Return. From the pop-up menu, select a fixed data rate for your digital line or select **Auto**. (The data rates to choose from range from 56 kbps to the highest synchronized line speed.) The Auto setting allows your Netopia Router to determine the data rate of your serial line at the time of circuit activation. For an asynchronous modem, the only encapsulation is PPP. Press Return.
3. Select **Invert Tx Clock** and toggle to **Yes** or **No** depending on whether you use this selection. Press Return.

   Invert Tx Clock causes transmitted data to be delayed by half a clock phase. This option is useful for X.21 DTEs (Data Terminal Equipment) because their transmit data can become altered in relation to the clock sourced by the DCE (Data Communications Equipment).

   DTE (Data Terminal Equipment) is a term used to define the equipment rate. It is a designation for the maximum rate at which a router can exchange information.

   DCE (Data Communications Equipment) is a term defined by both Frame Relay and X.25 committees that applies to switching equipment and is distinguished from the devices that attach to the network (DTE).
4. Select **Circuit Activation Requires** and from the pop-up menu select DCD-only, DSR-only, or DCD and DSR (the default). Press Return.

   Some V.35 interfaces represent their capability to transfer user data end-to-end with the DCD signal, while others offer a more accurate representation with DSR. For this latter case, you can choose to ignore DCD and instead sense DSR as the line status indicator.

   Note: This option will be hidden if an X.21 cable is attached.

5. Select **Data Link Encapsulation** and highlight the method of encapsulation that you want to use from the pop-up menu. The choices offered are PPP, HDLC, and Frame Relay. The default setting is Frame Relay. Press Return.

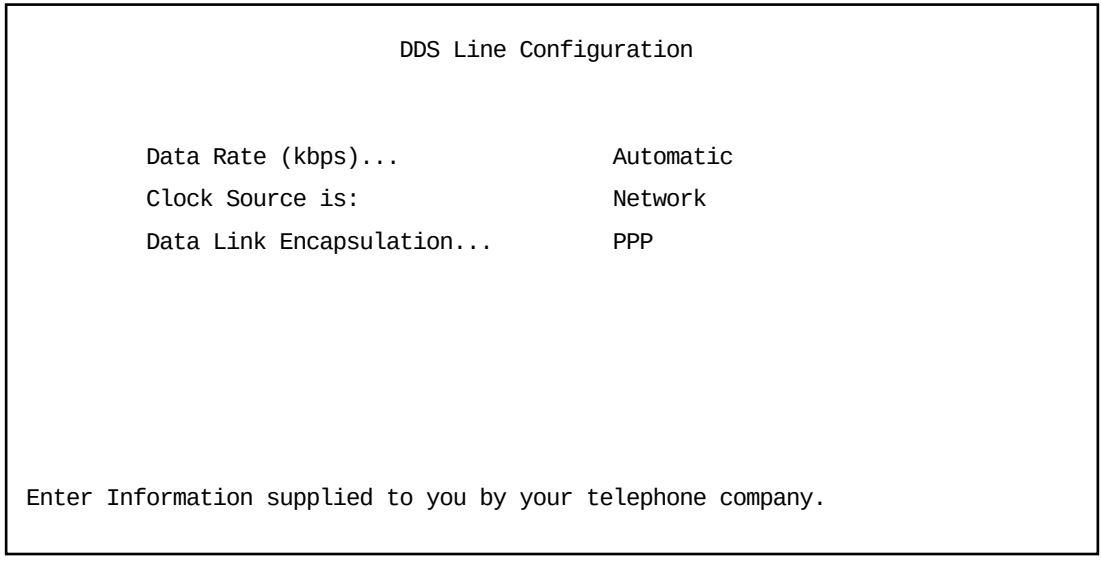
   Note: If you used Easy Setup to configure your router, you have already created a connection profile called Easy Setup Profile. If you return to the Easy Setup menus and change the Data Link Encapsulation method you set up in this step, the Easy Setup Data Link Encapsulation method will override this one and change the default data link encapsulation method in use.

You are now finished configuring the Line Configuration screen. Press the Escape key to return to the **WAN Setup** screen.

Note: If you selected Frame Relay as your data link encapsulation method, see “Configuring Frame Relay” on page 8-6 for more information.

Line configuration for a DDS line

The DDS Line Configuration screen is where you enter the configuration parameters for your leased line, in order for the Netopia Router to communicate with the physical connection.



1. Select **Data Rate** and press Return. From the pop-up menu, highlight the data rate that you want your DDS line connection to transmit at. The data rate choices are **56 kbps** and **64 kbps**. The default is Automatic. Press Return.

   Note: DDS Netopia Routers can run 56 kbps or 64 kbps data rates on permanent circuits. You can alternately select **Automatic**, in which case the router will hunt between modes until it can determine what the telephone company has provisioned your DDS line for.

2. The **Clock Source** default is Network and is not editable.

3. Select **Data Link Encapsulation** and highlight the method of encapsulation that you want to use from the pop-up menu. The choices offered are PPP, HDLC, and Frame Relay. The default setting is PPP. Press Return.

Note: If you used Easy Setup to configure your router, you have already created a connection profile called Easy Setup Profile. If you return to the Easy Setup menus and change the Data Link Encapsulation method you set up in this step, the Easy Setup Data Link Encapsulation method will override this one and change the default data link encapsulation method in use.

You are now finished configuring the Line Configuration screen. Press the Escape key to return to the **WAN Setup** screen.

Note: If you selected Frame Relay as your data link encapsulation method, see "Configuring Frame Relay" on page 8-6 for more information.

Line configuration for a T1 line

The T1 Line Configuration screen is where you enter the configuration parameters for your T1 line, in order for the Netopia Router to communicate with the physical connection.

```
                          T1 Line Configuration

        Line Encoding...                  B8ZS

        Framing Mode...                   ESF
        Transmit ANSI PRMs:               No

        Number of DS0 Channels:           1
        First DS0 Channel:                1


        Buildout (-dB)...                 0-0.6

        Channel Data Rate...              Nx64k
        Clock Source...                   Network

        Data Link Encapsulation...        Frame Relay


Enter Information supplied to you by your telephone company.
```

1. Select **Line Encoding** and press Return. From the pop-up menu, highlight the encoding your telephone service provider uses: **B8ZS** or **AMI**. The default setting is B8ZS. Press Return.
2. Select **Framing Mode** and press Return. From the pop-up menu, highlight either **ESF** or **D4**, depending on the framing mode that your telephone service provider advises you to use. The default setting is ESF. Press Return.
3. If you selected ESF framing mode, toggle **Transmit ANSI PRMs** either No (the default) or Yes. If you selected D4 framing mode, this option is not available.
4. Select **Number of DS0 Channels** and enter the number of DS0 channels that you and your telephone service provider have determined are necessary for your T1 line. The default setting for DS0 Channels is 1 (one). Press Return.

   Note: Each DS0 channel represents a 56k or 64k increment in bandwidth. Selecting a number less than the maximum of 24 specifies a fractional T1 interface.

For fractional T1, you can also specify in the check box whether the DS0 channels are contiguous or alternating.

5. Select **First DS0 Channel** and enter the number of the first active DS0 channel you will be using. The default setting is 1 (one). Press Return.

   Note: You can change the First DS0 Channel number, which has a valid range from one to the maximum number minus the number of active channels. If the number of active DS0 channels is 24 (maximum), **First DS0 Channel** is hidden.

   If you specify a number of DS0 channels less than the maximum, a Contiguous Channels item appears. For fractional-T1, you can specify whether the DS0 channels are contiguous or alternating by toggling **Contiguous Channels** to **Yes** or **No**.

6. Select **Buildout (-dB)** and press Return. From the pop-up menu, highlight the line buildout, which is the transmit attenuation of the line that you will be using. The choices in the menu include **Auto**, **0-0.6**, **7.5**, **15**.**0**, **22.5**, and **None**. The default setting is 0-0.6. Press Return.

   If Automatic is chosen, the attenuation of the transmission will be set to match the receiving signal level.

7. Select **Channel Data Rate** and highlight the data rate specified by your service provider. The channel data rate choices are **Nx56k** or **Nx64k**. The default is Nx64k. Press Return.

8. Select **Clock Source** and press Return. From the pop-up menu, highlight the clock source that you want to use. The choices offered are **Internal** Clock Source or **Network** Clock Source. The default is Network. Press Return.

9. Select **Data Link Encapsulation** and highlight the method of encapsulation that you want to use from the pop-up menu. The choices offered are **PPP**, **HDLC**, and **Frame Relay**. The default setting is Frame Relay. Press Return.

   Note: If you used Easy Setup to configure your router, you have already created a connection profile called Easy Setup Profile. If you return to the Easy Setup menus and change the Data Link Encapsulation method you set up in this step, the Easy Setup Data Link Encapsulation method will override this one and change the default data link encapsulation method in use.

You are now finished configuring the Line Configuration screen. Press the Escape key to return to the **WAN Setup** screen.

Note: If you selected Frame Relay as your data link encapsulation method, see “Configuring Frame Relay” on page 8-6 for more information.

Configuring Frame Relay

Frame Relay is an alternative data link encapsulation method for use over unswitched connections. If this does not apply to your connection, you can skip the corresponding sections.

You can specify Frame Relay as your data link encapsulation method in either of two ways:

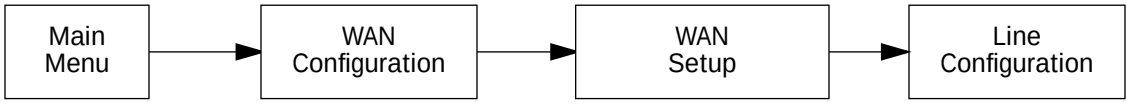
- the "Easy Setup Frame Relay screens" on page 8-6 or
- the "WAN Configuration Frame Relay screens" on page 8-7

Easy Setup Frame Relay screens


```
                    T1 Line Configuration

Line Encoding...                    B8ZS

Framing Mode...                     ESF


Number of DS0 Channels:             1
First DS0 Channel:                  1



Channel Data Rate...              +-------------+
                                  +-------------+
                                  | PPP         |
Data Link Encapsulation...        | HDLC        |
                                  | Frame Relay |
TO MAIN MENU                      +-------------+
```

WAN Configuration Frame Relay screens

The Line Configuration menu also offers the options of either PPP, HDLC, or Frame Relay as your data link encapsulation method.




```
                        T1 Line Configuration

Line Encoding...                    B8ZS

Framing Mode...                     ESF
Transmit ANSI PRMs:                 No

Number of DS0 Channels:             1
First DS0 Channel:                  1


Buildout (-dB)...                   Auto

Channel Data Rate...              +-------------+
Clock Source...                   +-------------+
                                  | PPP         |
Data Link Encapsulation...        | HDLC        |
                                  | Frame Relay |
                                  +-------------+
```

Frame Relay configuration

If you chose Frame Relay as your data link encapsulation type you can now configure the Frame Relay options from the WAN Configuration menu.

```
                              WAN Configuration

                      WAN (Wide Area Network) Setup...

                      Display/Change Connection Profile...
                      Add Connection Profile...
                      Delete Connection Profile...

                      Default Profile...



                      Frame Relay Configuration...
                      Frame Relay DLCI Configuration...




Return/Enter for WAN line configuration.
From here you will configure yours and the remote sites' WAN information.
```

From the WAN Configuration screen, select **WAN Setup**, then select the **Frame Relay Configuration** option and press Return. The Frame Relay Configuration screen appears.

```
                           Frame Relay Configuration

         LMI Type...                          ANSI (Annex D)
         T391 (Polling Interval in secs):     10
         N391 (Polls/Full Status Cycles):     6
         N392 (Error Threshold):              3
         N393 (Monitored Event Window):       4

         Tx Injection Management...           Standard
         Default CIR:                         64000
         Default Bc:                          64000
         Default Be:                          0

         Congestion Management Enabled:       No



         Maximum Tx Frame Size:               1520

Return/Enter goes to new screen.
Enter Information supplied to you by your telephone company.
```

1. Select **LMI Type** (Link Management Type) and press Return. From the pop-up menu, highlight either **ANSI (Annex D)**, **CCITT (Annex A)**, **LMI**, or **None**. The default is **None**. Press Return.

See "Frame Relay DLCI configuration" on page 8-10 for instructions.

Specifying the Link Management Type is the first step in configuring Frame Relay.

- If you select an LMI Type (Link Management Type) other than None, the **T391** option specifies the number of seconds between the Status Enquiry messages. The default setting is 10.
- The **N391** option specifies the frequency of full status polls, in increments of the basic (T391) polling cycle. The default setting is 6.
- The **N392** option specifies the maximum number of (link reliability, protocol, and sequence number) error events that can occur within the N393 sliding window. If an N392 threshold is exceeded, the switch declares the Netopia Router inactive. The default setting is 3.
- The **N393** option allows the user to specify the width of the sliding N392 monitored event window. The default setting is 4.

2. Select **Tx Injection Management** and press Return. From the pop-up menu, highlight **Standard** if you want the frames on your line that exceed the configured service parameters to be dropped at the router, **Buffered** if you want the frames on your line that exceed the link capacity to be delayed until the link is less busy, or **None** if you want all of the frames on your line to be transmitted. Press Return.

   Note: If you select **None** as the Tx Injection Management type, the three Tx Injection Management options listed below will remain hidden. Go to step 4.

   If you select **Standard** or **Buffered** as the Tx Injection Management type, then the **Default CIR**, **Bc**, and **Be** values will appear (in the corresponding fields below the Tx Injection Management field) in order for you to define the parameters of the management algorithm.

   - The **Default CIR** (CIR also referred to as Committed Information Rate) represents the average capacity available to a given PVC (Permanent Virtual Circuit) or DLCI (Data Link Connection Identifier). This setting defaults to 64000, but you may modify the capacity rate if this setting will not be applicable to you.
   - The **Default Bc** (Bc also referred to as Committed Burst Size) represents the maximum amount of data that your Frame Relay service provider agrees to transfer from a given PVC (Permanent Virtual Circuit) or DLCI (Data Link Connection Identifier). This setting defaults to 64000, but you may change the capacity rate if necessary.
   - The **Default Be** (Be also referred to as Excess Burst Size) represents the maximum amount of data that your Frame Relay service provider will attempt to deliver to a given PVC (Permanent Virtual Circuit) or DLCI (Data Link Connection Identifier). This setting defaults to 0, but you may change the capacity rate if necessary.

   Note: Some Frame Relay service providers allow for over-subscription of the DLCIs, which occurs when the total number of CIRs for all PVCs exceeds the line rate setup.

3. Select **Congestion Management Enabled** and toggle to **Yes** or **No** depending on whether you use this selection. Press Return.

   If Congestion Management is enabled, this option causes the Netopia Router to use in-bound FECNs (Forward Explicit Congestion Notification). This feature is designed to notify you that congestion avoidance procedures should be initiated where applicable for traffic in the same direction as the received frame. It indicates that the frame in question has encountered congested resources.

Note: The Congestion Management Enabled field will only appear if Standard or Buffered is selected as the option from the Tx Injection Management field.

4. Select **Maximum Tx Frame Size** and press Return. The default is automatically set to a value suitable for encapsulating a full Ethernet packet's transmission load; however you can change the Maximum Frame Size to suit your network's transmission load. Press Return.

You are now finished configuring the Frame Relay Configuration screen. Press the Escape key to return to the WAN Configuration screen. If you need to configure your DLCIs, go to the next section.

Frame Relay DLCI configuration

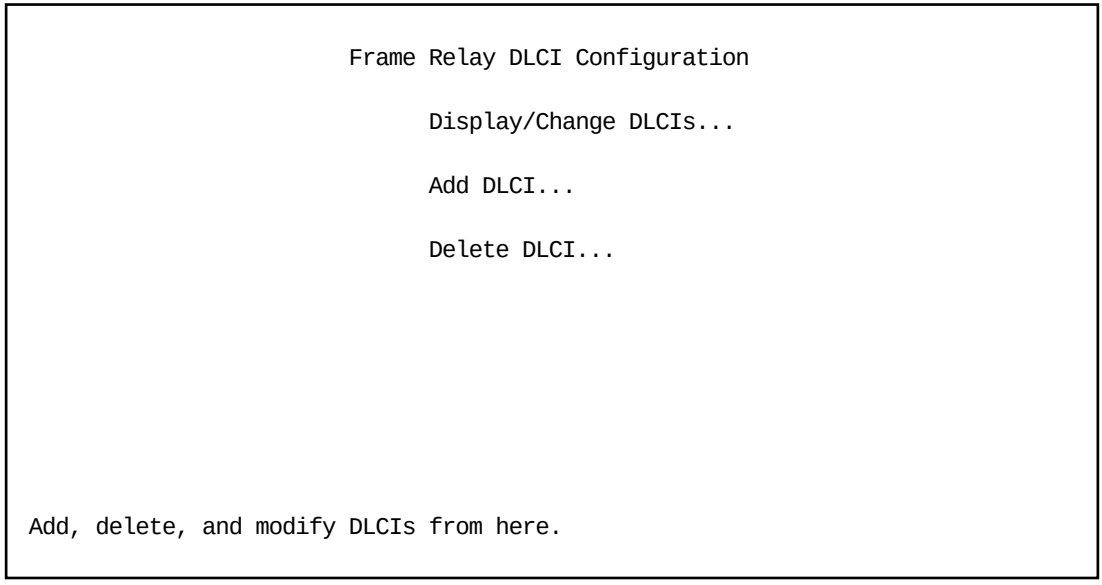
If you selected **None** as your LMI Type then you will need to manually configure your DLCIs.

A Frame Relay DLCI is a set of parameters that tells the Netopia Router how to initially connect to a remote destination.

The Netopia Router supports up to 16 different Frame Relay DLCI profiles.

Each Frame Relay DLCI configuration you set up allows the Netopia Router to connect your network to another network that uses IP or IPX over Frame Relay.

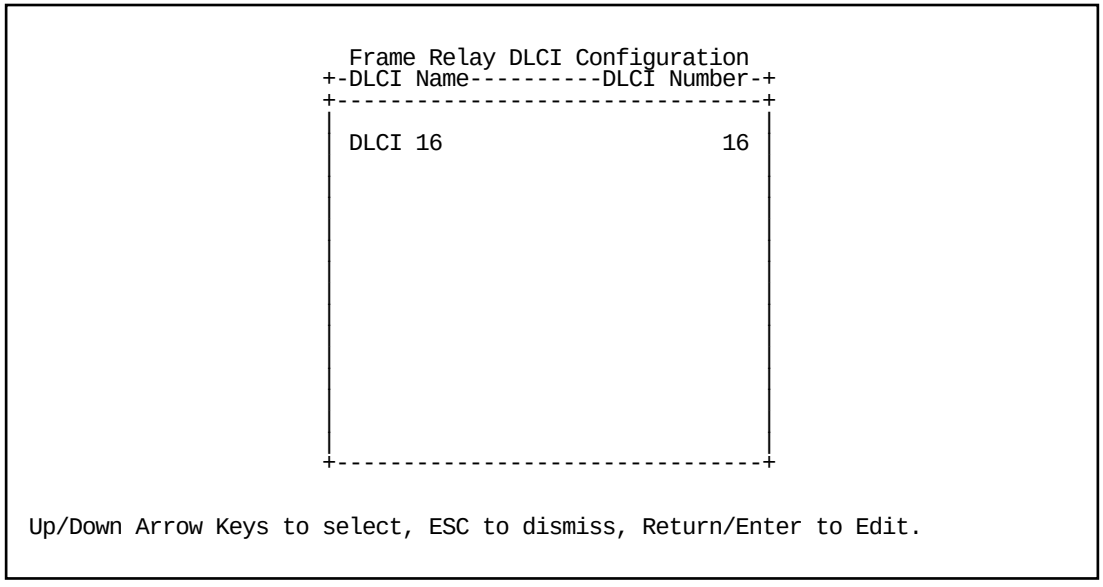
To go to the Frame Relay DLCI configuration screen, select **Frame Relay DLCI Configuration** in the WAN Configuration screen.



Displaying a Frame Relay DLCI configuration table

To display a view-only table of the Frame Relay DLCIs, select **Display/Change DLCIs** in the Frame Relay DLCI Configuration screen, and press Return.

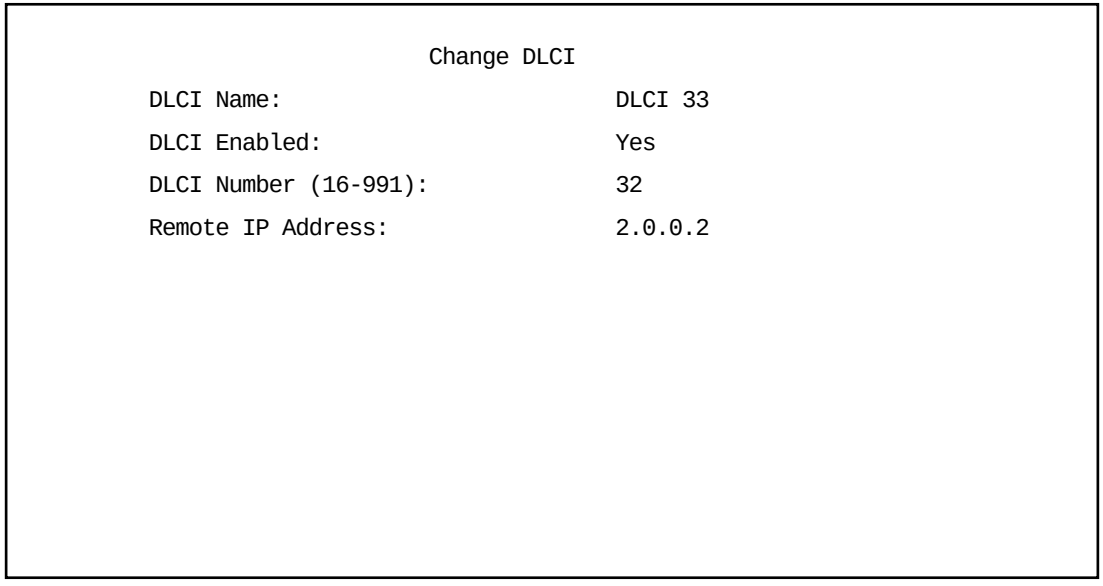
The Frame Relay DLCI Configuration table is a handy way to quickly view the DLCI names and DLCI numbers that you attribute to your Frame Relay profiles.



Changing a Frame Relay DLCI configuration

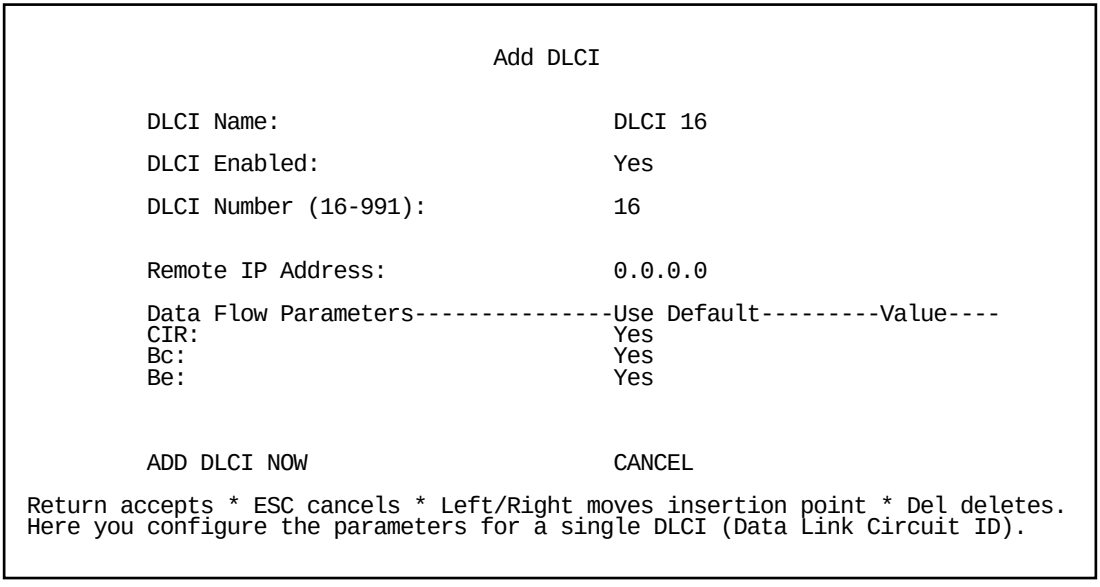
To modify a Frame Relay DLCI configuration, select **Display / Change DLCIs** in the Frame Relay DLCI Configuration screen.

Select a DLCI Name from the table and press Return to go to the **Change DLCI** screen. The parameters in this screen are the same as the parameters in the Add DLCI screen. To find out how to set them, see “Adding a Frame Relay DLCI configuration” on page 8-12.



Adding a Frame Relay DLCI configuration

To add a new Frame Relay DLCI, select **Add DLCI** in the Frame Relay DLCI Configuration screen and press Return. The Add DLCI screen appears.



1. Select **DLCI Name** and enter a name for this individual Frame Relay DLCI profile. It can be any name you want. For example: the name of your ISP or remote branch you're connecting to such as the corporate headquarters of your company.

   Note: The Netopia Router allows Frame Relay DLCIs to be named, so that you can easily reference and differentiate them. This is accomplished by giving a DLCI Name to a DLCI Number.

2. Select **DLCI Enabled** and toggle it to **Yes** to activate the profile. If you disable this profile, the Netopia Router will automatically disable and block access to a specific remote DLCI.

3. Select **DLCI Number (16-991)** and enter a number for this individual DLCI. Check with your Frame Relay provider to find out what numbers are allocated for each of your DLCI profiles. The DLCI number range should fall within the range of 16-991.

4. Select **Remote IP Address** and enter the remote IP address your ISP or network administrator gave you that represents the remote sites IP address for their router. Press Return.

If you selected **Standard** or **Buffered** as the Tx Injection Management type in the Frame Relay Configuration screen go to the next bulleted item below. If you selected **None** in the Frame Relay Configuration screen go to step 6.

Below the Remote IP Address field, the following Data Flow Parameters appear:

- The **CIR** (Committed Information Rate) represents the average capacity available to a given PVC (Permanent Virtual Circuit) or DLCI (Data Link Connection Identifier). The setting defaults to 64000, but you may modify the capacity rate by toggling the selection in the **Use Default** field to **No**. You can then enter a different capacity rate in the **Value** field.
- The **Bc** (Committed Burst Size) represents the maximum amount of data that your Frame Relay service

provider agrees to transfer from a given PVC (Permanent Virtual Circuit) or DLCI (Data Link Connection Identifier). The setting defaults to 64000, but you may modify the committed burst size by toggling the selection in the **Use Default** field to **No**. You can then enter a different committed burst size in the **Value** field.

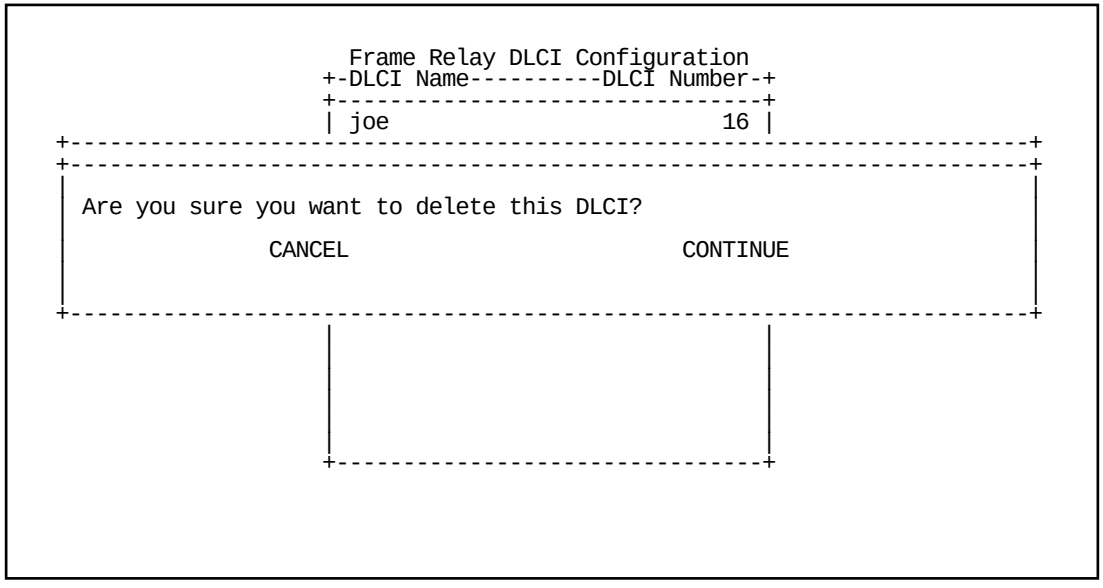
- The **Be** (Excess Burst Size) represents the maximum amount of data that your Frame Relay service provider will attempt to deliver to a given PVC (Permanent Virtual Circuit) or DLCI (Data Link Connection Identifier). The setting defaults to 0, but you may modify the excess burst size by toggling the selection in the **Use Default** field to **No**. You can then enter a different excess burst size in the **Value** field.

Note: Some Frame Relay service providers allow for over-subscription of the DLCIs, which occurs when the total number of CIRs for all PVCs exceeds the line rate setup.

5. Select **ADD DLCI NOW** to save the current static Frame Relay DLCI profile that you have just entered, and press Return to go back to the **Frame Relay DLCI Configuration** screen. Alternately, you can cancel the Frame Relay DLCI profile you have just created by selecting **CANCEL** to exit the Add DLCI screen.

Deleting a Frame Relay DLCI configuration

To delete a Frame Relay DLCI configuration, select **Delete DLCI** in the Frame Relay DLCI Configuration screen and press Return to display the Frame Relay DLCI configuration table.

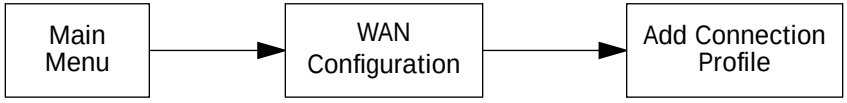


1. Highlight the Frame Relay DLCI configuration you wish to delete. Press Return.
2. A Frame Relay DLCI Configuration table appears with a prompt asking you if you want to delete the connection profile you have just highlighted. Select **CONTINUE** if you wish to delete this DLCI or **CANCEL** if you do not.

You are now finished configuring the Frame Relay DLCI Configuration screen.

Creating a new Connection Profile

Connection Profiles define the telco and networking protocols necessary for the router to make a remote connection. A Connection Profile is like an address book entry describing how the router is to get to a remote site, or how to recognize and authenticate a remote user dialing in to the router. For example, to create a new **Connection Profile**, you navigate to the **WAN Configuration** screen from the Main Menu, and select Add Connection Profile.



The **Add Connection Profile** screen appears.

```
                          Add Connection Profile

          Profile Name:                       Profile 02
          Profile Enabled:                    Yes

          IP Enabled:                         Yes
          IP Profile Parameters...

          IPX Enabled:                        No


          Data Link Encapsulation...          PPP
          Data Link Options...


          Telco Options...



          ADD PROFILE NOW                     CANCEL

Return accepts * ESC cancels * Left/Right moves insertion point * Del deletes.
Configure a new Conn. Profile. Finished?  ADD or CANCEL to exit.
```

On a Netopia R5000 Series Router you can add up to 15 more connection profiles, for a total of 16.

1. Select **Profile Name** and enter a name for this connection profile. It can be any name you wish. For example: the name of your ISP.
2. Toggle the **Profile Enabled** value to Yes or No. The default is Yes.
3. Select **IP Profile Parameters** and press Return. The IP Profile Parameters screen appears.

```
                          IP Profile Parameters

         Address Translation Enabled:       Yes

         Local WAN IP Address:              0.0.0.0

         Remote IP Address:                 0.0.0.0
         Remote IP Mask:                    0.0.0.0

         Filter Set...
         Remove Filter Set

         Receive RIP:                       Off




Toggle to Yes if this is a single IP address ISP account.
Configure IP requirements for a remote network connection here.
```

4. Toggle or enter any IP Parameters you require and return to the Add Connection Profile screen by pressing Escape. For more information, see “IP Setup and Network Address Translation” on page 9-1.

5. If your router is enabled for IPX routing (see “IPX Setup” on page 10-1) and you will be connecting with an IPX remote network, toggle **IPX Enabled** to Yes, and press Return. Otherwise, accept the default No. If IPX routing is not enabled, this menu item does not appear.

   If you enable IPX routing, an **IPX Profile Parameters** menu item becomes available. Select IPX Profile Parameters and press Return. The IPX Profile Parameters screen appears.

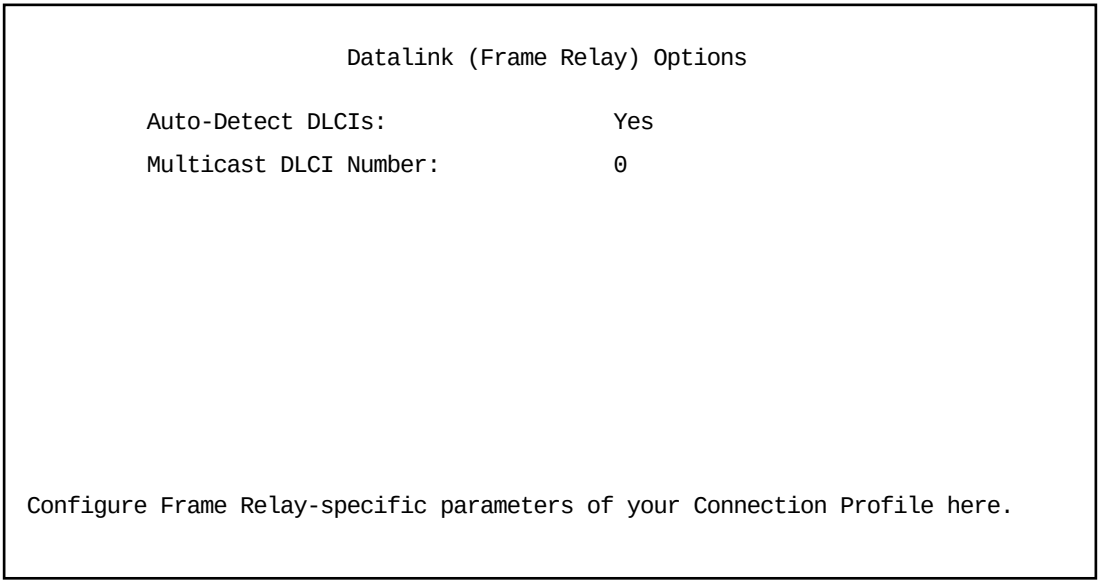
```
                          IPX Profile Parameters

         Remote IPX Network:                        00000000
         Path Delay:                                10
         NetBios Packet Forwarding:                 Off

         Incoming Packet Filter Set...              <<NONE>>
         Outgoing Packet Filter Set...              <<NONE>>

         Incoming SAP Filter Set...                 <<NONE>>
         Outgoing SAP Filter Set...                 <<NONE>>



         Periodic RIP Timer:                        60
         Periodic SAP Timer:                        60




Configure IPX requirements for a remote network connection here.
```

6. Toggle or enter any IPX Parameters you require and return to the Add Connection Profile screen by pressing Escape. For more information, see "IPX Setup" on page 10-1.

7. Select **Datalink Options** and press Return.

   The Datalink Options screen appears. The Datalink Options screen will vary depending on the data link encapsulation method you are using.

   The Frame Relay options screen appears as follows:



   You can toggle **Auto-Detect DLCIs** to Yes (the default) or No for this profile.

   You can enter the DLCI Number you want to multicast, if any.

The PPP options screen for a switched interface appears as follows:

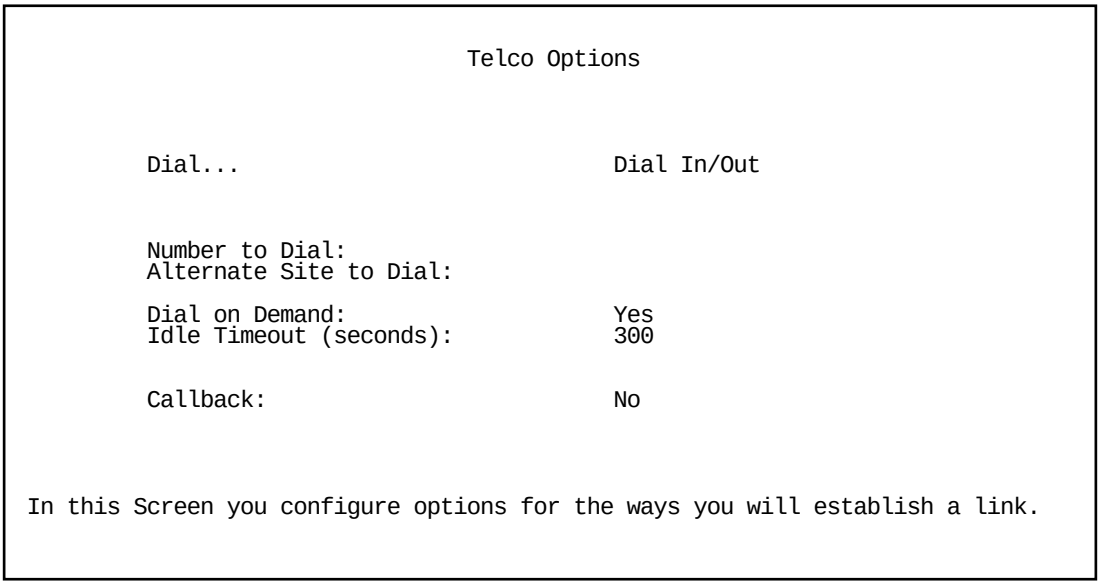
```
                          Datalink (PPP/MP) Options

         Data Compression...                Standard LZS

         Send Authentication...             PAP

         Send User Name:
         Send Password:

         Receive User Name:
         Receive Password:




         Maximum Packet Size:               1500


In this Screen you will configure the PPP/MP specific connection params.
```

You can accept the defaults, or change them if you wish. You can also specify user name and password for both outgoing and incoming calls. the Send User Name/Password parameters are used to specify your identity when dialing out to a remote location. The Receive User Name/Password parameters are used when receiving dial-in clients such as via RAS configuration.

Return to the Add Connection Profile screen by pressing Escape.

8. For a switched connection only, select **Telco Options** and press return. the Telco Options screen appears.

   Note: For IDSL routers, which do not initiate dial-up connections, this option does not appear.



   Select **Dial** and press Return. A pop-up menu appears. You can select the dialing options for this Connection Profile as Dial In Only, Dial Out Only, or Dial In/Out.

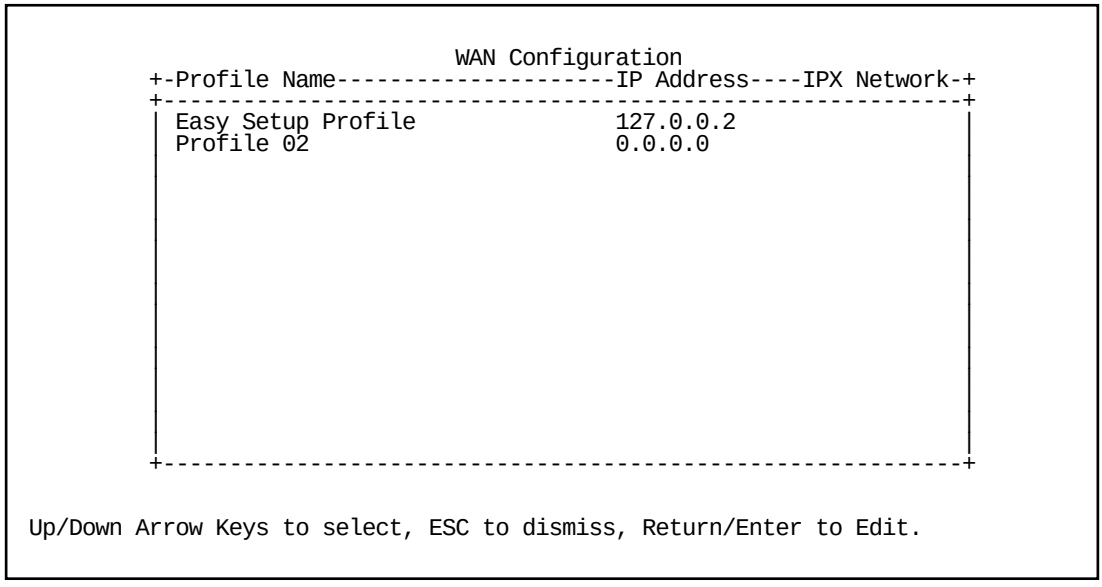
   You can:

   - add the number to dial for this Connection Profile
   - add an alternate number
   - change any of the default parameter settings

   When you are finished with these entries, press Escape to return to the **Add Connection Profile** screen.

9. Select **ADD PROFILE NOW** and press Return. Your new Connection Profile will be added.

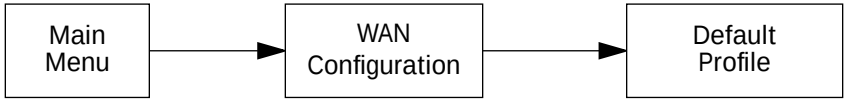
If you want to view the Connection Profiles in your router, return to the WAN Configuration screen, and select **Display / Change Connection Profile**. The list of Connection Profiles is displayed in a scrolling pop-up screen.



If you create a Connection Profile using a particular datalink encapsulation method, that profile will take precedence whenever you connect to a line that uses that datalink encapsulation. If there is no Connection Profile with the datalink encapsulation method that the line uses, the router will default to using the Default Profile. See “The default profile,” for more information.

The default profile

For R5100 SA and R5300 T1 models the Default Profile screen controls whether or not the communication link will come up without an explicitly configured connection profile. If you have an R5200 DDS model, you can skip this section. See "Connection Profiles" on page 9-8 for more information. You access the Default Profile screen from the Main Menu by selecting WAN Configuration and then selecting **Default Profile**.



The Default Profile screen appears.

```
                              Default Profile

          Must Match a Defined Profile:      No

          IP Enabled:                        Yes
          IP Parameters...

          IPX Enabled:                       Yes
          IPX Parameters...









Configure Default WAN Connection Parameters here.
```

- You can set Must Match a Defined Profile item to Yes or No (the default). This item controls whether or not the communication link will come up without an explicitly configured connection profile. If your ISP is serving you a dynamic IP Address, you need not explicitly configure a connection profile, and the default behavior of the router will be to connect automatically once it is powered on.

  If Must Match a Defined Profile is set to No, then an IP Enabled item is visible. Toggling this item to Yes (the default) or No controls whether or not IP will be supported on the communication link. If IP Enabled is set to Yes, an IP Parameters item becomes visible. If you select IP Parameters the IP Parameters screen appears (see "IP parameters (default profile) screen" on page 8-21). This screen allows you to configure various IP parameters for connections established without an explicitly configured connection profile.

If Must Match a Defined Profile is set to No, then an IPX Enabled item is visible. Toggling this item to Yes or No (the default) controls whether or not IPX will be supported on the communication link. If IPX Enabled is set to Yes, an IPX Parameters item becomes visible. If you select IPX Parameters, the IPX Parameters screen appears (see "IPX parameters (default profile) screen" on page 8-22). This screen allows you to configure various IPX parameters for connections established without an explicitly configured connection profile.

IP parameters (default profile) screen

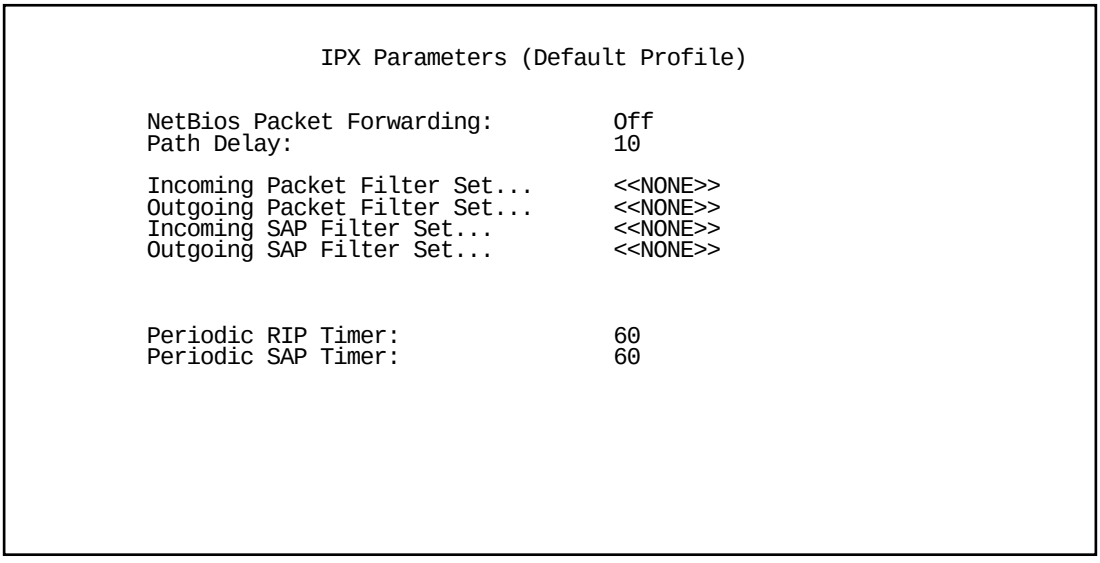
The IP Parameters (Default Profile) screen allows you to configure various IP parameters for connections established without an explicitly configured connection profile:

```
                        IP Parameters (Default Profile)



          Address Translation Enabled:       No


          Filter Set (Firewall)...
          Remove Filter Set

          Receive RIP:                       Both
          Transmit RIP:                      Off









Return/Enter accepts * Tab toggles * ESC cancels.
```

The Netopia R5000 Series Router always acts as a DHCP client on the communication link when using a Default Profile. The DHCP server will supply a local IP address and subnet mask. For a communication link, Network Address Translation (NAT) is enabled by default in the Default Profile. For details on setting up IP Parameters see "IP Setup and Network Address Translation" on page 9-1.

IPX parameters (default profile) screen

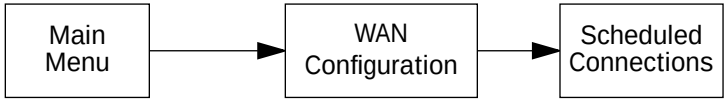
The IPX Parameters (Default Profile) screen allows you to configure various IPX parameters for connections established without an explicitly configured connection profile:



For details on setting up IPX Parameters see "IPX Setup" on page 10-1. For details on setting up Filter Sets see "Security" on page 13-1.

Scheduled connections (switched async only)

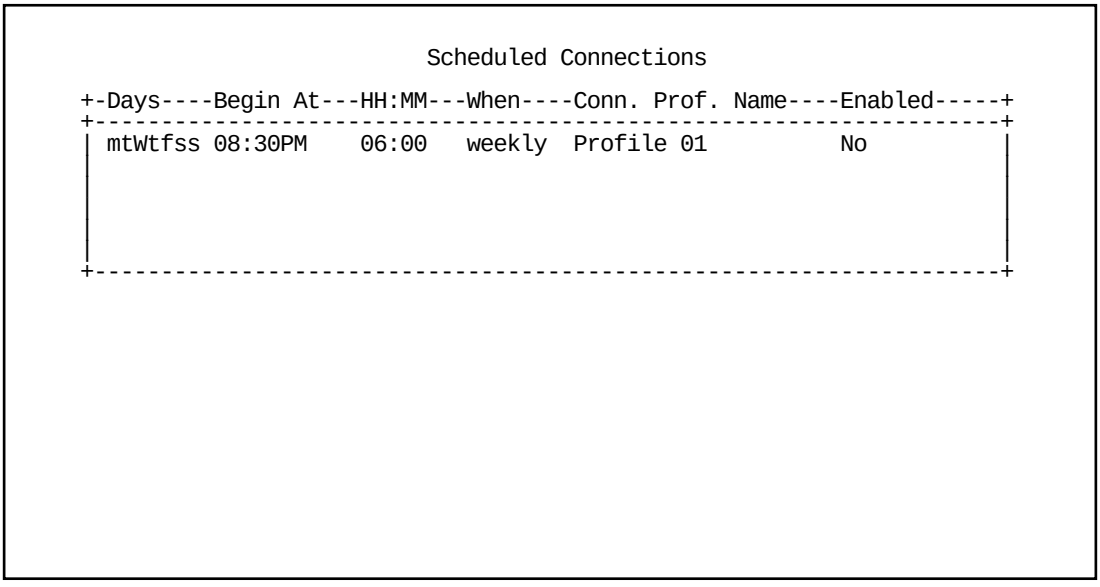
To go to the Scheduled Connections screen, select **Scheduled Connections** in the WAN Configuration screen.




```
                        Scheduled Connections

                    Display/Change Scheduled Connection...
                    Add Scheduled Connection...
                    Delete Scheduled Connection...




Navigate from here to add/modify/change/delete Scheduled Connections.
```

Viewing scheduled connections

To display a table of view-only scheduled connections, select **Display / Change Scheduled Connection** in the Scheduled Connections screen. Each scheduled connection occupies one row of the table.



The first column in the table shows a one-letter representation of the **Days** of the week, from Monday (M or m) to Sunday (S or s). If a letter representing a day is capitalized, the connection will be activated on that day; a lower-case letter means that the connection will not be activated on that day. If the scheduled connection is configured for a once-only connection, the word "once" will appear instead of the days of the week.

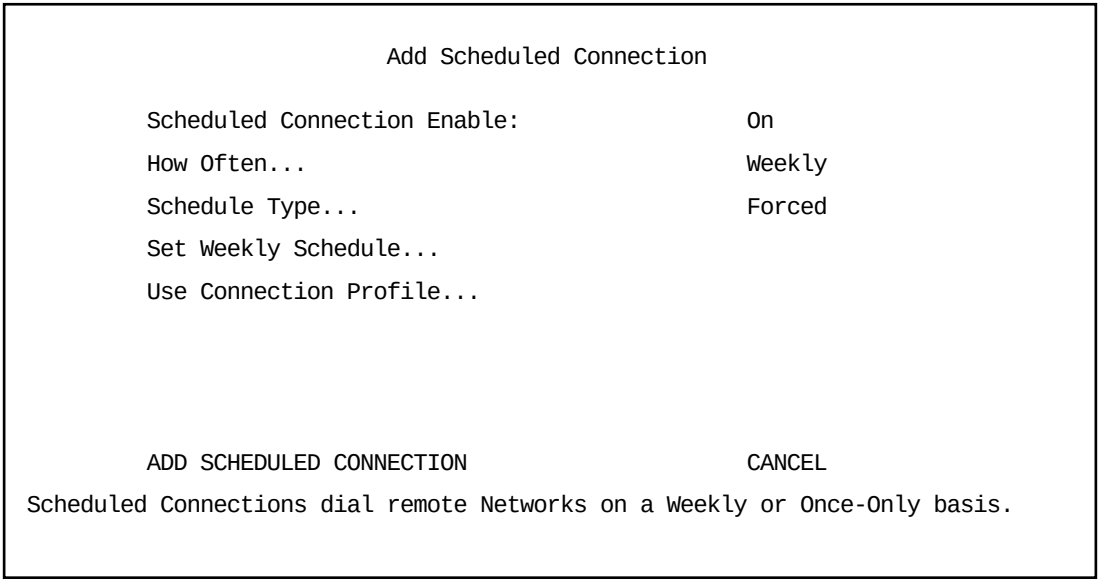
The other columns show:

- The time of day that the connection will **Begin At**
- The duration of the connection (**HH:MM**)
- Whether it's a recurring **Weekly** connection or used **Once Only**
- Which connection profile (**Conn. Prof.**) is used to connect
- Whether the scheduled connection is currently **Enabled**

The router checks the date and time set in scheduled connections against the system date and time.

Adding a scheduled connection

To add a new scheduled connection, select **Add Scheduled Connection** in the Scheduled Connections screen and press Return. The Add Scheduled Connection screen appears.



Follow these steps to configure the new scheduled connection:

- To activate the connection, select **Scheduled Connection Enable** and toggle it to **On**. You can make the scheduled connection inactive by toggling **Scheduled Connection Enable** to **Off**.
- Decide how often the connection should take place by selecting **How Often** and choosing **Weekly** or **Once Only** from the pop-up menu.
- The **Schedule Type** allows you to set the exact weekly schedule or once-only schedule.

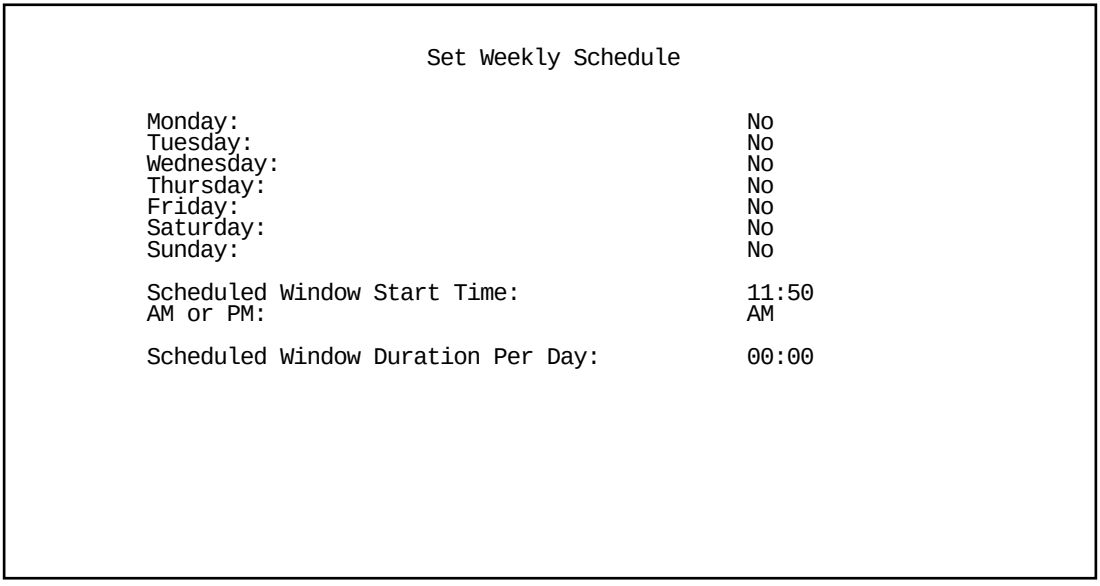
  Options are:

  - **Forced Up**, meaning that this connection will be maintained whether or not there is a demand call on the line.
  - **Forced Down**, meaning that this connection will be torn down or blocked whether or not there is a demand call on the line.
  - **Demand-Allowed**, meaning that this schedule will permit a demand call on the line.
  - **Demand-Blocked**, meaning that this schedule will prevent a demand call on the line.
  - **Periodic**, meaning that the connection is retried several times during the scheduled time.
- If **How Often** is set to **Weekly**, the item directly below **How Often** reads **Set Weekly Schedule**. If **How Often** is set to **Once Only**, the item directly below **How Often** reads **Set Once-Only Schedule**.

Set Weekly Schedule

If you set **How Often** to **Weekly**, select **Set Weekly Schedule** and go to the Set Weekly Schedule screen.

- Select the days for the scheduled connection to occur and toggle them to **Yes**.

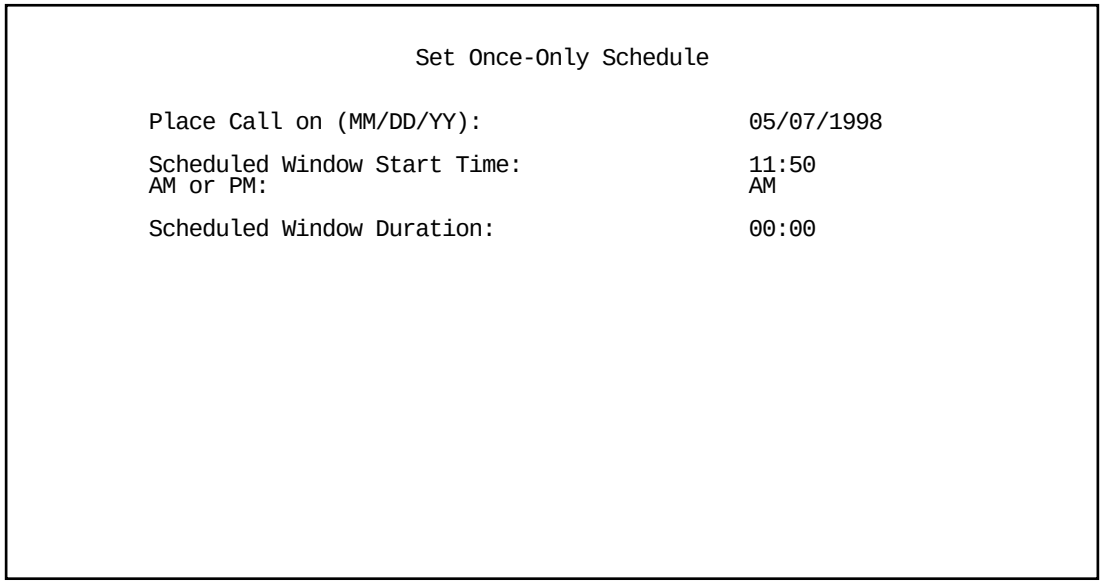


- Select **Scheduled Window Start Time** and enter the time to initiate the scheduled connection.
- You must enter the time in the format H:M, where H is a one- or two-digit number representing the hour and M is a one- or two-digit number representing the minutes. The colon is mandatory. For example, the entry 1:3 (or 1:03) would be accepted as 3 minutes after one o'clock. The entry 7:0 (or 7:00) would be accepted as seven o'clock, exactly. The entries 44, :5, and 2: would be rejected.
- Select **AM or PM** and choose **AM** or **PM** from the pop-up menu.
- Select **Scheduled Window Duration Per Day** and enter the maximum duration allowed for this scheduled connection, per call.

  You are finished configuring the weekly options. Return to the Add Scheduled Connection screen to continue.

Set Once-Only Schedule

If you set **How Often** to **Once Only**, select **Set Once-Only Schedule** and go to the Set Once-Only Schedule screen.



- Select **Place Call On (Date)** and enter a date in the format MM/DD/YY or MM/DD/YYYY (month, day, year).

  Note: You must enter the date in the format specified. The slashes are mandatory. For example, the entry 5/7/98 would be accepted as May 7, 1998. The entry 5/7 would be rejected.

- Select **Scheduled Window Start Time** and enter the time to initiate the scheduled connection.

  Note: You must enter the time in the format H:M, where H is a one- or two-digit number representing the hour and M is a one- or two-digit number representing the minutes. The colon is mandatory. For example, the entry 1:3 (or 1:03) would be accepted as 3 minutes after one o'clock. The entry 7:0 (or 7:00) would be accepted as seven o'clock, exactly. The entries 44, :5, and 2: would be rejected.

- Select **AM or PM** and choose **AM** or **PM**.

- Select **Scheduled Window Duration** and enter the maximum duration allowed for this scheduled connection. Use the same format restrictions noted above.

You are finished configuring the once-only options. Return to the Add Scheduled Connection screen to continue.

- In the Add Scheduled Connection screen, select **Use Connection Profile** and choose from the list of connection profiles you have already created. A scheduled connection must be associated with a connection profile to be useful. The connection profile becomes active during the times specified in the associated scheduled connection, if any exists.

- Select **ADD SCHEDULED CONNECTION** to save the current scheduled connection. Select **CANCEL** to exit the Add Scheduled Connection screen without saving the new scheduled connection.

Modifying a scheduled connection

To modify a scheduled connection, select **Change Scheduled Connection** in the Scheduled Connections screen to display a table of scheduled connections.

Select a scheduled connection from the table and go to the Change Scheduled Connection screen. The parameters in this screen are the same as the ones in the Add Scheduled Connection screen (except that **ADD SCHEDULED CONNECTION** and **CANCEL** do not appear). To find out how to set them, see "Adding a scheduled connection" on page 8-25.

Deleting a scheduled connection

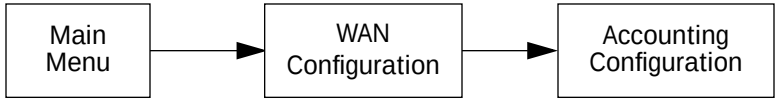
To delete a scheduled connection, select **Delete Scheduled Connection** in the Scheduled Connections screen to display a table of scheduled connections.

Select a scheduled connection from the table and press the Return key to delete it. To exit the table without deleting the selected scheduled connection, press the Escape key.

Connection accounting screens (switched async only)

For an R5100 Serial router connected to an asynchronous modem, you can enable system-wide and per connection profile connection accounting and budgeting. You use this feature to track first minutes and additional minutes per time period for initiated data calls. Connection accounting is available either through the console-based management screens or through the web-based management screens. See "Web-based monitoring" on page 12-20 for more information.

You access the console-based management screens from the WAN Configuration menu by selecting Accounting Configuration and pressing Return.

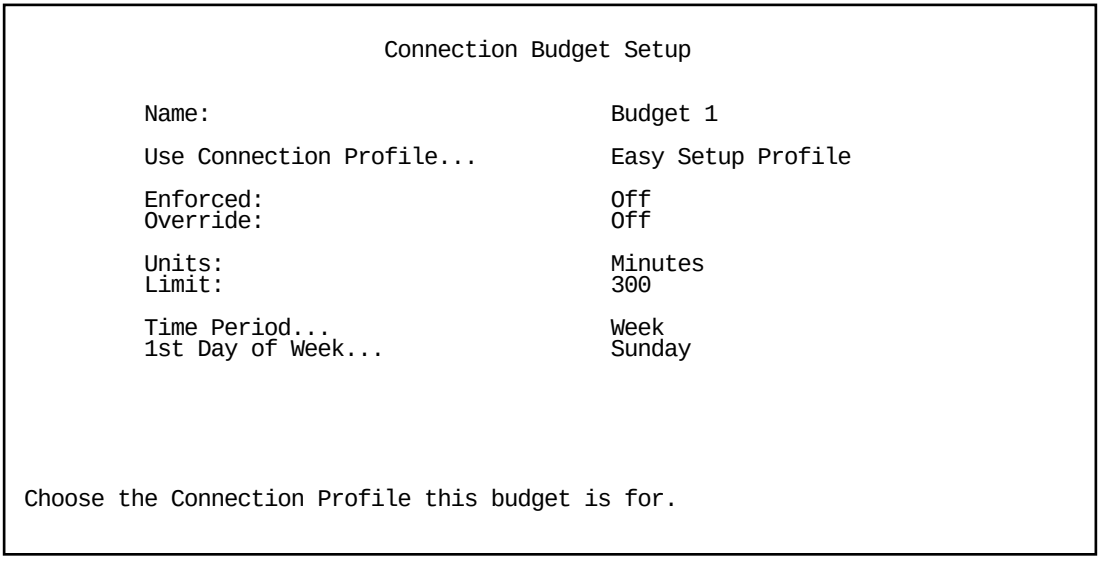


The Accounting Configuration screen appears.

```
                    Accounting Configuration


        Router Budgets
        Enable Router Budget:              On
        Day for auto-reset of timers:      0
        Maximum Aggregate connect time:    0:00
                                         +----------+
        Connection Budgets               +----------+
        Budgets...                       | Budget 1 |
                                         | Budget 2 |
                                         | Budget 3 |
                                         +----------+
```

To edit your budgets select **Budgets**, and from the pop-up menu, select the budget you want to edit.

The Budget Setup screen appears.

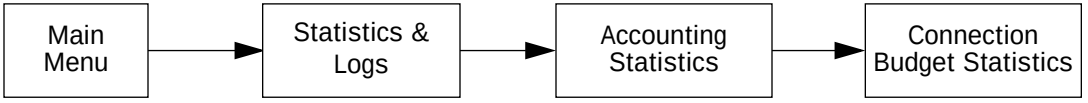


Configuration is similar to the web-based management configuration screens.

- Selecting **Use Connection Profile** displays a pop-up list of all of your connection profiles. Choose the connection profile you want this budget to apply to and press Return.
- Toggle **Enforced** to either **On** or **Off** to enforce whether the connection is torn down when the budget limit is reached.
- Toggle **Override** to either **On** or **Off**. With Override on you can exceed your budget during the current time period without tearing down active connections. At the end of the current time period this option is automatically deactivated. If you want to be able to exceed your enforced budget again, you must toggle this option to On for each new time period.

  Toggling **Override** to On disables call blocking, even if the call is over its limit. The override flag is automatically reset to be Off at the start of a new period. This is so that you don't need to set Enforced to Off to by-pass the limit, and then forget to turn it back on when the new period starts.
- The **Units** (Minutes) field is not editable.
- In the **Limit** field enter the number of minutes your budget allows.
- From the **Time Period** pop-up select either **Week** or **Month**, depending on your budgeting requirements.
- If you set the time period to Week, from the **1st Day of Week** pop-up select the day of the week on which your budget starts.
  If you set the time period to Month, from the **1st Day of Month** pop-up select the day of the month on which your budget starts.

You can monitor your usage against your budget by reviewing the **Connection Budget Statistics** screen in the Accounting Statistics. From the Main Menu select **Statistics & Logs** and then **Accounting Statistics** and then **Connection Budget Statistics**.



The Budget Statistics screen appears.

```
                        Budget Statistics (in HHHH:MM)

Budget Name------First Minutes----Additional Minutes-------Cutoff--Expired
Budget 1                0:00                  0:00         2:00
Budget 2                0:00                  0:00         5:00
Budget 3                0:00                  0:00        10:00
```

You can view statistics for all your budgets at once or one at a time.

- **Budget Name** shows the names of your budgets.
- **First Minutes** displays the number of first minutes of outbound calls placed during the recording interval.
- **Additional Minutes** displays the remaining time of all outbound calls placed during the recording interval.
- **Cutoff** displays the number of hours budgeted for this connection profile.
- **Expired** displays the amount of time used against the budgeted amount.

To clear the counters and reset the statistics, use the down arrow key to select a budget and press Return. A pop-up window will ask you to confirm that you want to clear this budget's statistics. You can cancel if you change your mind. To return to the Accounting Statistics screen, press Escape.

Note: If you have Connection Budgets configured, changing the date setting (see "Date and time" on page 8-34) will reset the Connection Budgets under one of the following conditions:

- If the new date is greater than the old date and the new date falls outside of the current budget window; or
- If the new date is in the past and the date is not the current date (i.e., yesterday or earlier).

A warning message is displayed in the console window when a budget is reset.

System configuration screens

You can connect to the Netopia R5000 Series Router's system configuration screens in either of two ways:

- By using Telnet with the Router's Ethernet port IP address
- Through the console port, using a local terminal (see "Connecting a console cable to your router" on page 6-3)

You can also retrieve the Netopia R5000 Series Router's configuration information and remotely set its parameters using the Simple Network Management Protocol (see "SNMP" on page 12-13).

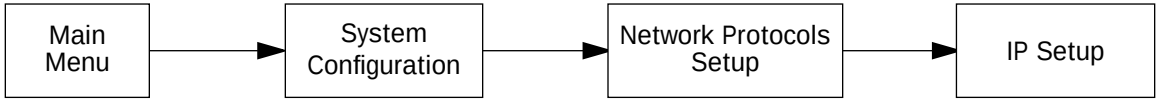
Open a Telnet connection to the router's IP address; for example, "192.168.1.1."

The console screen will open to the Main Menu, similar to the screen shown below:

```
                        Netopia R5100 v4.3.3

                    Easy Setup...
                    WAN Configuration...
                    System Configuration...
                    Utilities & Diagnostics...
                    Statistics & Logs...
                    Quick Menus...
                    Quick View...



Return/Enter goes to Easy Setup -- minimal configuration.
You always start from this main screen.
```

Navigating through the system configuration screens

To help you find your way to particular screens, some sections in this guide begin with a graphical path guide similar to the following example:



This particular path guide shows how to get to the Network Protocols Setup screens. The path guide represents these steps:

1. Beginning in the Main Menu, select **System Configuration** and press Return. The System Configuration screen appears.

2. Select **Network Protocols** and press Return. The Network Protocols screen appears.
3. Select **IP Setup** and press Return. The IP Setup screen appears.

To go back in this sequence of screens, use the Escape key.

System configuration features

The Netopia R5000 Series Router's default settings may be all you need to configure your Netopia R5000 Series Router. Some users, however, require advanced settings or prefer manual control over the default selections. For these users, the Netopia R5000 Series provides system configuration options.

To help you determine whether you need to use the system configuration options, review the following requirements. If you have one or more of these needs, use the system configuration options described in later chapters.

- System configuration of dynamic IP address distribution through DHCP, MacIP, or BootP
- Greater network security through the use of filters
- System configuration of AppleTalk LAN settings
- System configuration of connections to AppleTalk networks through the Internet or any IP network, using AURP (AppleTalk "tunneling")
- System configuration of connection profiles

To access the system configuration screens, select **System Configuration** in the Main Menu, then press Return.

The System Configuration menu screen appears:

```
                          System Configuration

                    Network Protocols Setup...
                    Filter Sets (Firewalls)...
                    IP Address Serving...

                    Date and Time...

                    Console Configuration...

                    SNMP (Simple Network Management Protocol)...

                    Security...

                    Upgrade Feature Set...


                    Logging...

Return/Enter to configure Networking Protocols (such as TCP/IP).
Use this screen if you want options beyond Easy Setup.
```

Network protocols setup

These screens allow you to configure your network's use of the standard networking protocols:

- IP: Details are given in "IP Setup and Network Address Translation" on page 9-1.
- IPX: Details are given in "IPX Setup" on page 10-1.
- AppleTalk: Details are given in "AppleTalk Setup" on page 11-1.

  Note: AppleTalk requires the optional AppleTalk feature expansion kit.

Filter sets (firewalls)

These screens allow you to configure security on your network by means of filter sets and a basic firewall.

- Details are given in "Security" on page 13-1.

IP address serving

These screens allow you to configure IP address serving on your network by means of DHCP, WANIP, BootP, and with the optional AppleTalk kit, MacIP.

- Details are given in "IP address serving" on page 9-22.

Date and time

You can set the system's date and time in the Set Date and Time screen.

Select **Date and Time** in the System Configuration screen and press Return. The Set Date and Time screen appears.

```
                          Set Date and Time

System Date Format:                          MM/DD/YY
Current Date (MM/DD/YY):                     3/16/1999

System Time Format:                          AM/PM
Current Time:                                10:29
AM or PM:                                    AM
```

Follow these steps to set the system's date and time:

1. Select **Current Date** and enter the date in the appropriate format. Use one- or two-digit numbers for the month and day, and the last two digits of the current year. The date's numbers must be separated by forward slashes (/).
2. Select **Current Time** and enter the time in the format HH:MM, where HH is the hour (using either the 12-hour or 24-hour clock) and MM is the minutes.
3. Select **AM or PM** and choose **AM** or **PM**.

Note: If you have Connection Budgets configured, changing the date setting will reset the Connection Budgets under one of the following conditions:

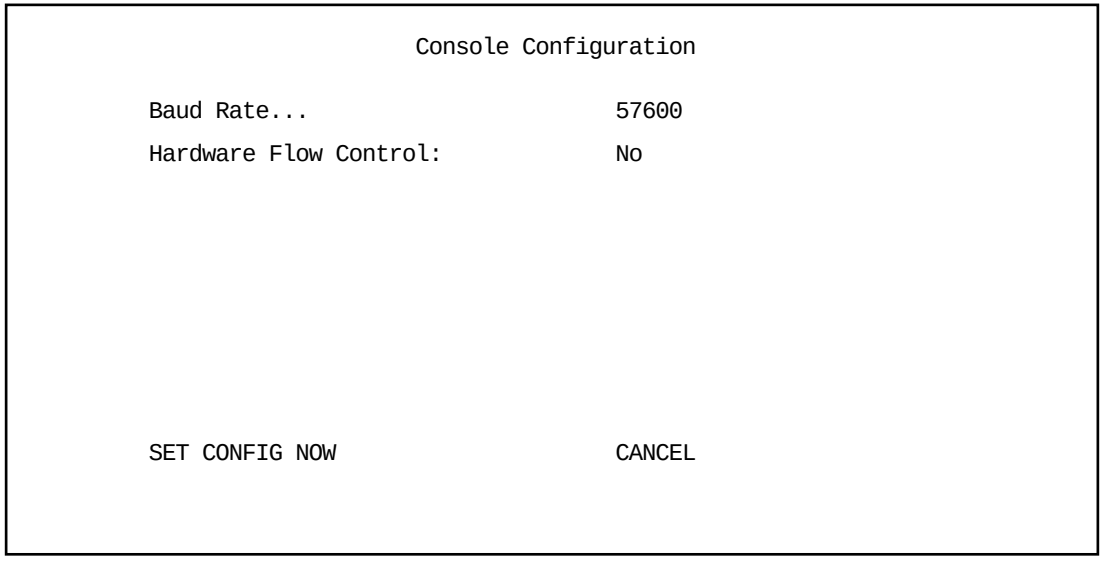
If the new date is greater than the old date and the new date falls outside of the current budget window; or, if the new date is in the past and the date is not the current date (i.e. yesterday or earlier). A warning message is displayed in the console window when a budget is reset.

See "Connection Budgets page" on page 12-26 for more information.

Console configuration

You can change the default terminal communications parameters to suit your requirements.

To go to the Console Configuration screen, select **Console Configuration** in the System Configuration screen.



Follow these steps to change a parameter's value:

1. Select the parameter you want to change.
2. Select a new value for the parameter. Return to step 1 if you want to configure another parameter.
3. Select **SET CONFIG NOW** to save the new parameter settings. Select **CANCEL** to leave the parameters unchanged and exit the Console Configuration screen.

SNMP (Simple Network Management Protocol)

These screens allow you to monitor and configure your network by means of a standard Simple Network Management Protocol (SNMP) agent.

- Details are given in "SNMP" on page 12-13.

Security

These screens allow you to add users and define passwords on your network.

- Details are given in "Security" on page 13-1.

Upgrade feature set

You can upgrade your Netopia R5000 Series Router by adding new feature sets through the Upgrade Feature Set utility.

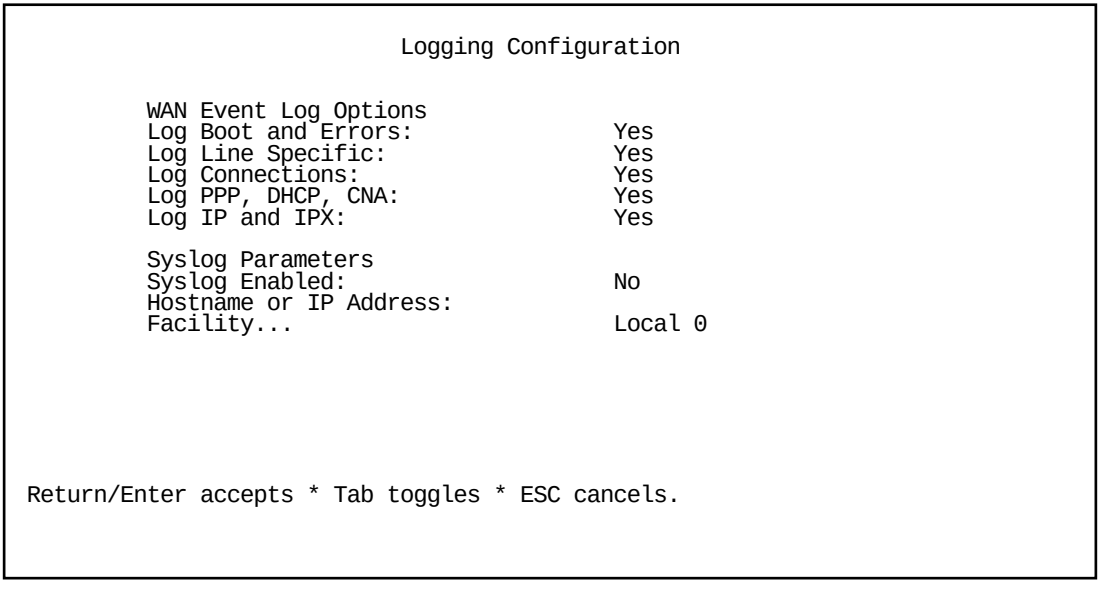
See the release notes that came with your router or feature set upgrade, or visit the Netopia Web site at www.netopia.com for information on new feature sets, how to obtain them, and how to install them on your Netopia R5000 Series.

Logging

You can configure a UNIX-compatible syslog client to report a number of subsets of the events entered in the router's WAN Event History. See "WAN Event History" on page 12-7. The Syslog client (for the PC only) is supplied as a .ZIP file on the Netopia CD.

Select **Logging** from the System Configuration menu.

The Logging Configuration screen appears.



By default, all events are logged in the event history.

- By toggling each event descriptor to either **Yes** or **No**, you can determine which ones are logged and which are ignored.
- You can enable or disable the syslog client dynamically. When enabled, it will report any appropriate and previously unreported events.
- You can specify the syslog server's address either in dotted decimal format or as a DNS name up to 63 characters.
- You can specify the UNIX syslog Facility to use by selecting the **Facility** pop-up.

Installing the Syslog client

The Goodies folder on the Netopia CD contains a Syslog client daemon program that can be configured to report the WAN events you specified in the Logging Configuration screen.

To install the Syslog client daemon, exit from the graphical Netopia CD program and locate the CD directory structure through your Windows desktop or through Windows Explorer. Go to the Goodies directory on the CD and locate the Sds15000.exe program. This is the Syslog daemon installer. Run the Sds15000.exe program and follow the on screen instructions for enabling the Windows Syslog daemon.

The following screen shows a sample syslog dump of WAN events:

```
Mar  5 10:14:06 tsnext.netopia.com   Link 1 down: PPP PAP failure
Mar  5 10:14:06 tsnext.netopia.com >>Issued Speech Setup Request from our DN: 5108645534
Mar  5 10:14:06 tsnext.netopia.com   Requested Disc. from DN: 917143652500
Mar  5 10:14:06 tsnext.netopia.com   Received Clear Confirm for our DN: 5108645534
Mar  5 10:14:06 tsnext.netopia.com   Link 1 down: Manual disconnect
Mar  5 10:14:06 tsnext.netopia.com >>Issued Speech Setup Request from our DN: 5108645534
Mar  5 10:14:06 tsnext.netopia.com   Requested Disc. from DN: 917143652500
Mar  5 10:14:06 tsnext.netopia.com   Received Clear Confirm for our DN: 5108645534
Mar  5 10:14:06 tsnext.netopia.com   Link 1 down: No answer
Mar  5 10:14:06 tsnext.netopia.com --Device restarted----------------------------------------
Mar  5 10:14:06 tsnext.netopia.com >>Received Speech Setup Ind. from DN: (not supplied)
Mar  5 10:14:06 tsnext.netopia.com   Requested Connect to our DN: 5108645534
Mar  5 10:14:06 tsnext.netopia.com   ASYNC: Modem carrier detected (more) Modem reports: 26400
V34
Mar  5 10:14:06 tsnext.netopia.com >>WAN: 56K Modem 1 activated at 115 Kbps
Mar  5 10:14:06 tsnext.netopia.com   Connect Confirmed to our DN: 5108645534
Mar  5 10:14:06 tsnext.netopia.com   PPP: Channel 1 up, Answer Profile name: Default Profile
Mar  5 10:14:06 tsnext.netopia.com    PPP: NCP up, session 1, Channel 1 Final (fallback)
negotiated auth: Local PAP , Remote NONE
Mar  5 10:14:06 tsnext.netopia.com   PPP: PAP  we accepted remote, Channel 1 Remote name: guest
Mar  5 10:14:06 tsnext.netopia.com    PPP: MP negotiated, session 1 Remote EDO: 06 03
0000C5700624 0
Mar  5 10:14:06 tsnext.netopia.com   PPP: CCP negotiated, session 1, type: Ascend LZS Local
mode: 1, Remote mode: 1
Mar  5 10:14:06 tsnext.netopia.com   PPP: BACP negotiated, session 1 Local MN: FFFFFFFF, Remote
MN: 00000001
Mar  5 10:14:06 tsnext.netopia.com   PPP: IPCP negotiated, session 1, rem: 192.168.10.100 local:
192.168.1.1
Mar  5 10:14:06 tsnext.netopia.com >>WAN: 56K Modem 1 deactivated
Mar  5 10:14:06 tsnext.netopia.com   Received Clear Ind. from DN: 5108645534, Cause: 0
Mar  5 10:14:06 tsnext.netopia.com   Issued Clear Response to DN: 5108645534
Mar  5 10:14:06 tsnext.netopia.com   Link 1 down: Remote clearing
Mar  5 10:14:06 tsnext.netopia.com   PPP: IPCP down, session 1
Mar  5 10:14:06 tsnext.netopia.com >>Received Speech Setup Ind. from DN: (not supplied)
```

Chapter 9

IP Setup and Network Address Translation

The Netopia R5000 Series Router uses Internet Protocol (IP) to communicate both locally and with remote networks. This chapter shows you how to configure the router to route IP traffic. You also learn how to configure the router to serve IP addresses to hosts on your local network and to configure Network Address Translation.

This section covers the following topics:

Network Address Translation allows communication between the LAN connected to the Netopia R5000 Series Router and the Internet using a single IP address instead of an routed with individual IP addresses for each computer on the network.

Network Address Translation also provides increased security by hiding the local IP addresses of the LAN connected to the Netopia R5000 Series from the outside world.

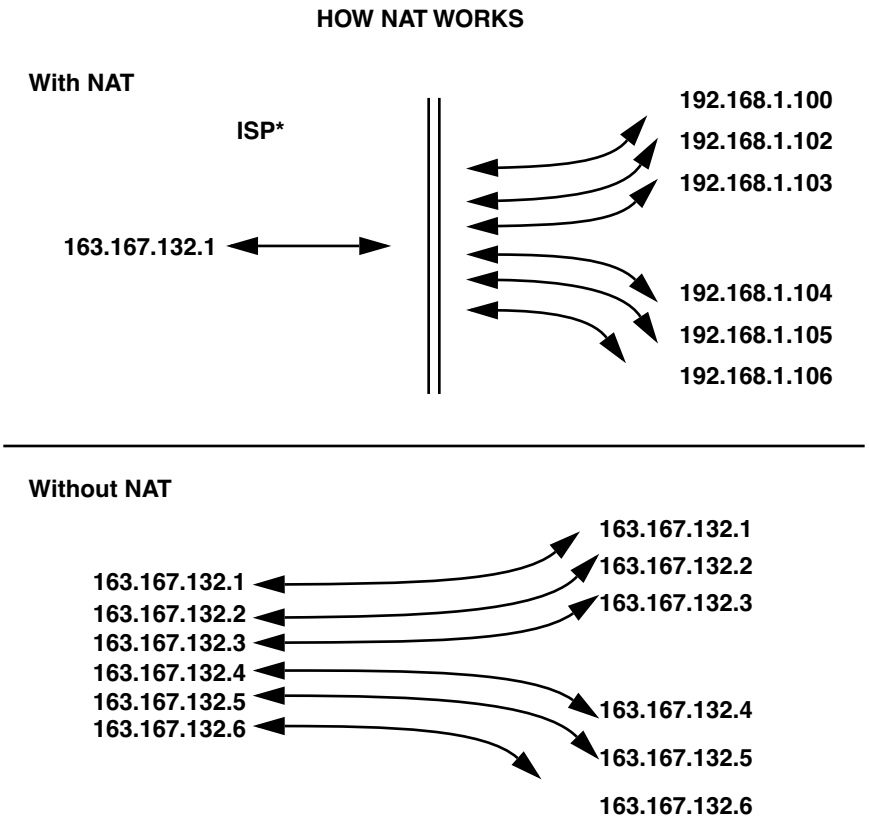
For a detailed discussion of Network Address Translation, see Appendix C, "Understanding Netopia NAT Behavior."

Network Address Translation features

Network Address Translation (NAT) offers users the following features:

- NAT is selectable on a per connection basis, optionally allowing real addresses to be used for intranet connections and proxied addresses to be used for Internet connections.
- You can use any combination of NAT (proxied) and non-NAT (unproxied) addresses simultaneously on the available connection channels. For instance, one non-NAT connection profile can be used to connect to corporate headquarters, while another NAT connection profile can simultaneously connect your Netopia R5000 Series Router and LAN to the Internet.
- In a one-to-many NAT connection the single address on the WAN side may be acquired at connection time from the remote side. The address can be assigned by the remote router from either a dynamic pool of addresses or a fixed, static address.
- Static NAT security is simpler and more reliable because only one IP address needs a firewall, and because the internal network structure is not visible from the Internet.
- Netopia's NAT implementation allows for multiple servers (mail, web, ftp, etc.) to be accessible from the WAN or Internet. However, only one server of each application type (or TCP port) can be accessed from the WAN or Internet. Making a LAN server available to the WAN is called exporting a service.

NAT works by remapping the source IP address of traffic from the LAN to a single static or dynamically assigned IP address shown to the remote side of the router.



The feature can be implemented on a per–connection profile basis. The network router can use two or more connection profiles simultaneously to connect to two or more networks. Each profile can have NAT enabled.

When NAT is enabled, the Netopia R5000 Series Router can use either a statically assigned IP address or one dynamically assigned each time the router connects to the ISP. While a dynamically assigned IP address offers the ISP more flexibility, it does have an important limitation: the router requires a static IP address to support Web, FTP, or other services available to the WAN. To support these services with NAT enabled, a service can be associated with only one machine on the LAN.

When connected to the Internet or some other large network using NAT, the individual machines on your LAN are not directly accessible from the WAN. NAT provides an inherently secure method of connection to the outside world.

Using Network Address Translation

The following procedure describes how to use Network Address Translation.

1. Pick a network number for your local network (referred to as the internal network). This can be any IP address range you want. The Netopia R5000 Series Router has a default IP address of 192.168.1.1. You may choose to change this address to match a pre-existing addressing scheme. For this example, we will use 10.0.0.0.

   Note: The outside world (the external network) will not see this network number.

2. Using the internal network number, assign addresses to the local nodes on your LAN. For example, you could assign

   - 10.0.0.1 to your Netopia R5000 Series Router
   - 10.0.0.2 to a node running as a World Wide Web server
   - 10.0.0.3 to an FTP server
   - 10.0.0.4 to a Windows NT PC
   - 10.0.0.5 to a Windows 95 PC

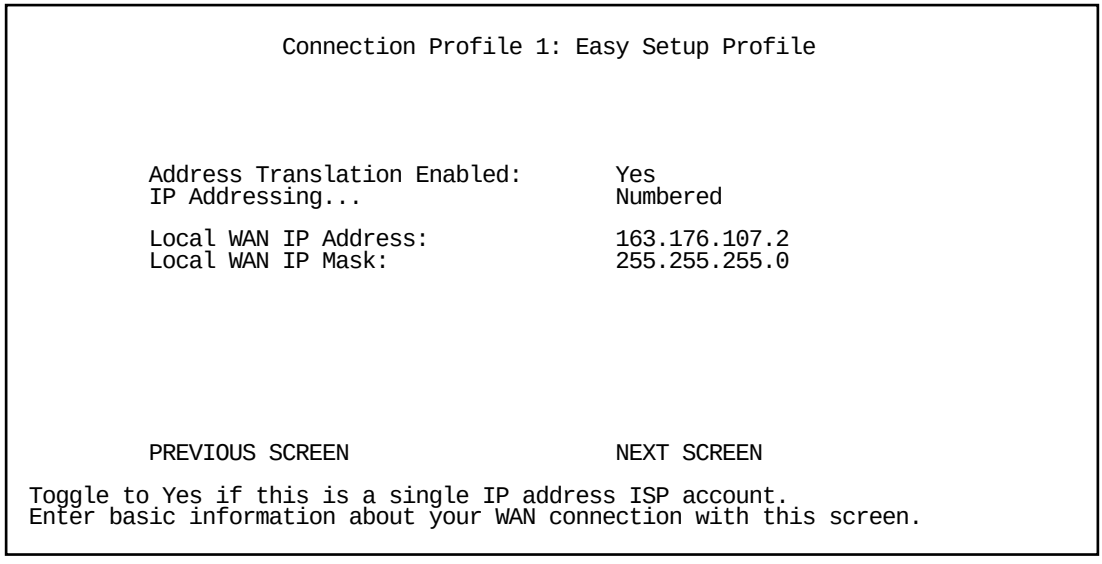
   Note: See "Associating port numbers with nodes" on page 9-7.

3. In the connection profile, toggle **Address Translation Enabled** to **Yes** or **No** (Yes to enable NAT) and press Return.

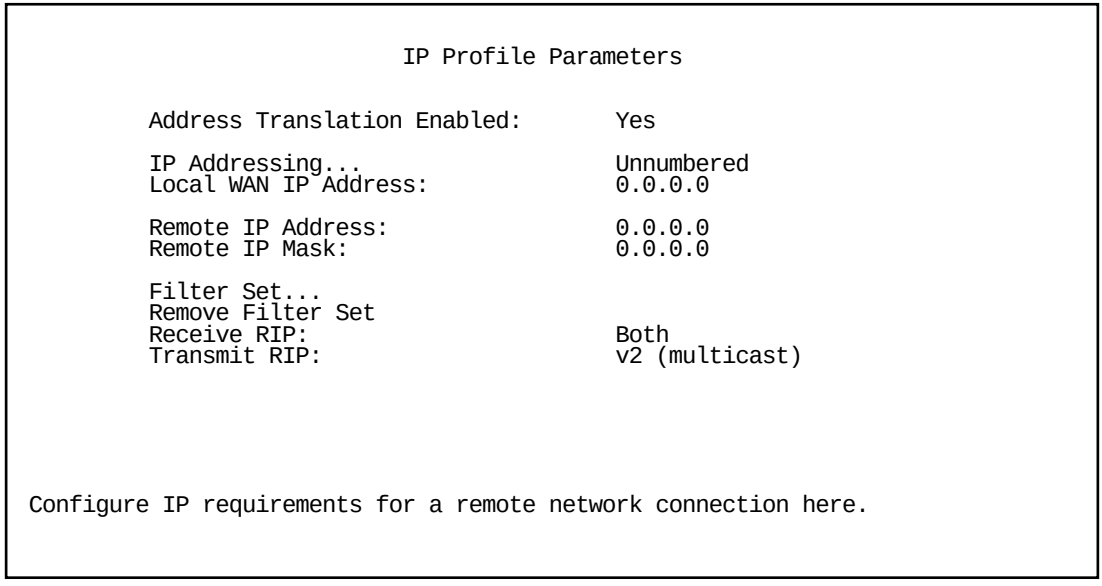
   The Easy Setup connection profile is accessible by using either of the following two approaches:

- From the Easy Setup menu in the Main Menu screen, select the next screen, **Connection Profile 1: Easy Setup Profile**.

  The Easy Setup Profile screen appears.



- Alternatively, from the WAN Configuration menu in the Main Menu screen, select **Display / Change Connection Profile**. When that screen appears, select **IP Profile Parameters**. You can now access the Address Translation option from the IP Profile Parameters menu.



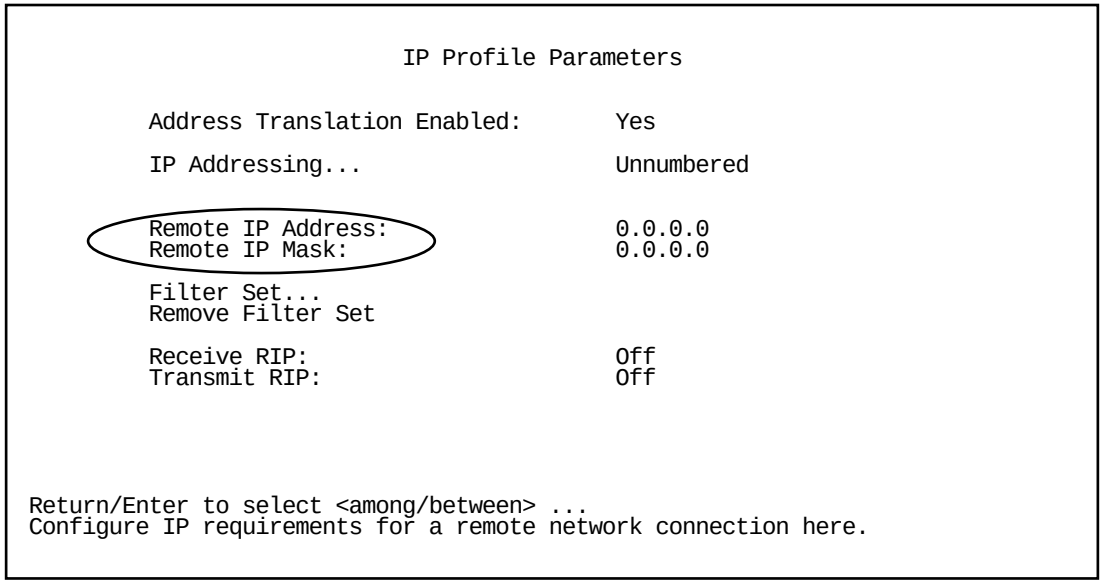
4. Select **IP Addressing** and, from the pop-up menu, choose the IP routing method that your ISP or network administrator specifies (either Numbered or Unnumbered). For more information see Appendix B, "Understanding IP Addressing," and Appendix C, "Understanding Netopia NAT Behavior."

5. If your ISP uses numbered (interface-based) routing, select **Local WAN IP Address** and enter the local WAN address your ISP gave you. Then select **Local WAN IP Mask** and enter the WAN subnet mask of the remote site you will connect to.

   The default address is 0.0.0.0, which allows for dynamic addressing, meaning that your ISP assigns an address via DHCP when you connect. In leased line connections, ISPs more commonly use static addressing, in which case you must enter a specific address. If you want to make LAN resources available to the WAN or Internet, you will need to use static addressing.

```
                          IP Profile Parameters

        Address Translation Enabled:       Yes

        IP Addressing...                   Numbered
        Local WAN IP Address:              0.0.0.0
        Local WAN IP Mask:                 0.0.0.0


        Filter Set...
        Remove Filter Set

        Receive RIP:                       Off




Enter an IP address in decimal and dot form (xxx.xxx.xxx.xxx).
Configure IP requirements for a remote network connection here.
```

Note: The Local WAN IP Address is displayed for numbered and/or NAT profiles. The Local WAN IP Mask is displayed for numbered profiles. The Remote IP Address and Remote IP Mask are displayed for unnumbered profiles.



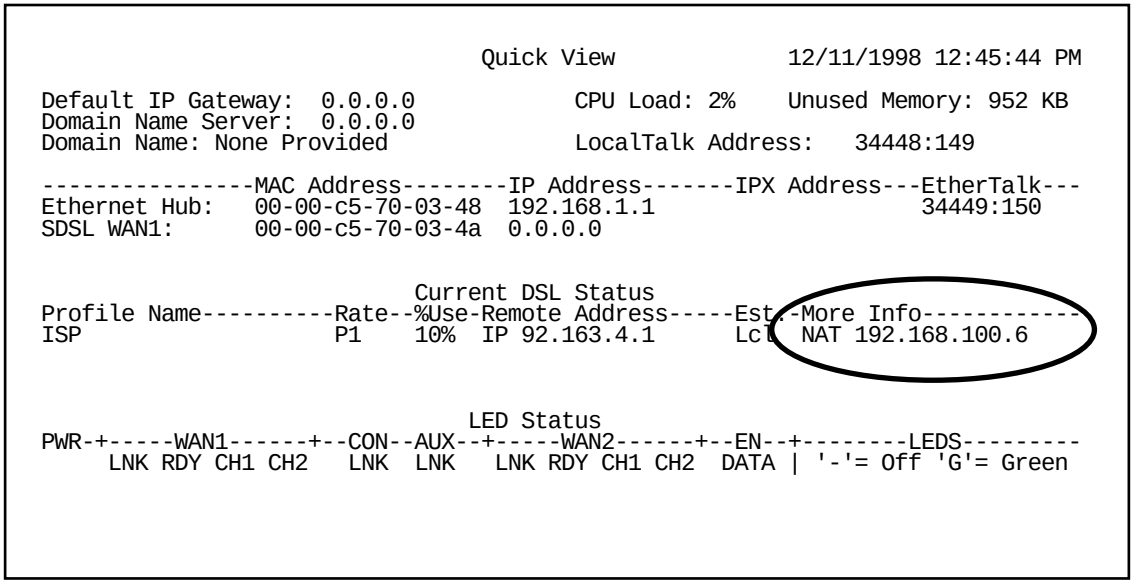
When using numbered interfaces, the Netopia Router will use its local WAN IP address and subnet mask to send packets to the remote router. Both routers have WAN IP addresses and subnet masks associated with the connection.

6. If your ISP uses unnumbered (system-based) routing, select **Remote IP Address** and enter the IP address your ISP gave you. Then select **Remote IP Mask** and enter the IP subnet mask of the remote site you will connect to.

   Note: When using unnumbered interfaces, the Netopia Router will use either its local Ethernet IP address or its NAT (Network Address Translation) address (if so configured) and subnet mask to send packets to the remote router. Neither router has a WAN IP address or subnet mask associated with this connection. These default addresses will request that the remote router dynamically assign an address at the time the connection is made.

7. If you entered 0.0.0.0, when your Netopia R5000 Series Router connects to the ISP, the remote router assigns your Netopia R5000 Series Router an IP address that external users use to communicate with your network.

   The following Quick View screen shows an example in which 192.168.100.6 is assigned to the Netopia R5000 Series Router. "NAT" indicates that the address was assigned dynamically by Network Address Translation.



Internal users can access the Internet as they always do; the external Internet, however, views all traffic from the internal network as originating from 192.168.100.6 and all traffic your network receives is addressed to 192.168.100.6.

Associating port numbers with nodes

When an IP client such as a Netscape Navigator or Microsoft Internet Explorer wants to establish a session with an IP server such as a Web server, the client machine must know the IP address to use and the TCP service port where the traffic is to be directed.

For example, a Web browser locates a Web server by using a combination of the IP address and TCP port that the client machine has set up.

Just as an IP address specifies a particular computer on a network, ports are addresses that specify a particular service in a computer. There are many universally agreed-upon ports assigned to various services. For example:

- Web servers typically use port number 80
- All FTP servers use port number 21
- Telnet uses port number 23
- SNMP uses port number 161

To help direct incoming IP traffic to the appropriate server, the Netopia R5000 Series Router lets you associate these and other port numbers with distinct IP addresses on your internal LAN using the feature called exported services. See “IP setup” on page 9-12 for details.

Advanced IP/IPX router configuration options

Advanced users can optionally use connection profiles to configure the IP and IPX protocol stack interfaces on the WAN link. You need not explicitly define these parameters, however. The following information is provided as reference to the possible router configurations advanced users may desire.

The IP router interface on the WAN link:

- may be numbered or unnumbered.
- may or may not use Network Address Translation (NAT).
- will attempt to autoconfigure itself without an explicitly configured connection profile, if permitted to do so by the setting of the Must Match a Defined Profile item in the Default Profile screen. See "The default profile" on page 8-20.

The link up process at the interface between the WAN data link encapsulation module and the IP router functions as follows:

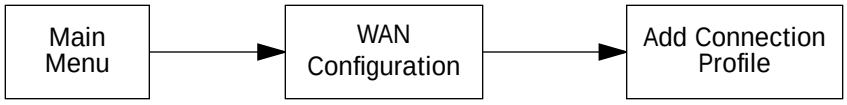
- When the WAN data link comes up, the router will search for a configured connection profile that specifies WAN encapsulation.
- If more than one WAN profile exists, the router will use the first such profile.
- If no WAN profile exists, and the Must Match a Defined Profile field in the Default WAN Profile is set to No, the router will construct a Default Profile, and the link up process will continue using this constructed profile as if it were an explicitly configured one.
- If no WAN profile exists, and the Must Match a Defined Profile field in the Default WAN Profile is set to Yes, IP will not come up on the WAN link. The router will log an "IP connection refused" event in the WAN Event History.
- If a WAN profile exists (or a default one has been constructed), the router will attempt to configure its interface on the WAN link using the information stored in the profile.

Connection Profiles

Since you will probably only have a single connection to your ISP over the WAN link, you may not need to create multiple connection profiles. Multiple connection profiles are useful on leased (unswitched) interfaces only to support meshed WAN connections. If you do not intend to set up meshed WAN connections, you do not need to create multiple connection profiles.

Connection profiles may be used to define the connection information for your WAN Auxiliary Port access.

Connection profiles define the line and networking protocols necessary for the router to make a remote connection. A connection profile is like an address book entry describing how the router is to get to a remote site, or how to recognize and authenticate a remote user dialing in to the router. For example, to create a new Connection Profile, you navigate to the WAN Configuration screen from the Main Menu, and select Add Connection Profile.



The Add Connection Profile screen appears.

```
                          Add Connection Profile

          Profile Name:                     Profile 02
          Profile Enabled:                  Yes

          IP Enabled:                       Yes
          IP Profile Parameters...

          IPX Enabled:                      No


          Data Link Encapsulation...        ATM FUNI









          ADD PROFILE NOW                   CANCEL

Return accepts * ESC cancels * Left/Right moves insertion point * Del deletes.
Configure a new Conn. Profile. Finished?  ADD or CANCEL to exit.
```

On a Netopia R5000 Series Router you can add up to 15 more connection profiles, for a total of 16, although only one can be used at a time.

1. Select **Profile Name** and enter a name for this connection profile. It can be any name you wish. For example: the name of your ISP.
2. Toggle the **Profile Enabled** value to Yes or No. The default is Yes.
3. Select **IP Profile Parameters** and press Return. The IP Profile Parameters screen appears.

```
                          IP Profile Parameters

        Address Translation Enabled:       Yes

        IP Addressing...                   Unnumbered
        Local WAN IP Address:              0.0.0.0
        Local WAN IP Mask:                 0.0.0.0
        Remote IP Address:                 0.0.0.0
        Remote IP Mask:                    0.0.0.0

        Filter Set...
        Remove Filter Set

        Receive RIP:                       Both
        Transmit RIP:                      v2 (multicast)

Configure IP requirements for a remote network connection here.
```

4. Toggle or enter any IP parameters you require and return to the Add Connection Profile screen by pressing Escape. For more information on NAT, see "Using Network Address Translation," beginning on page 9-3. For more information on IP addressing, see Appendix B, "Understanding IP Addressing."

   The Local WAN IP Address is displayed for numbered or NAT profiles. The Local WAN IP Mask is displayed for numbered profiles. The Remote IP Address and Remote IP Mask are displayed for unnumbered profiles.

5. If you will be connecting with an IPX remote network, toggle **IPX Enabled** to Yes, and press Return. Otherwise, accept the default No.

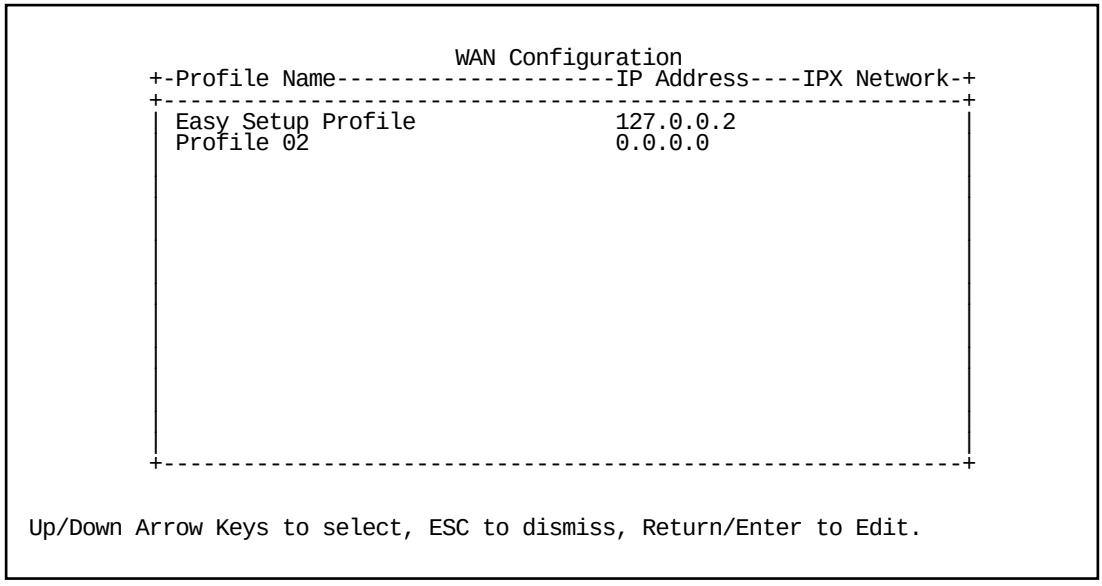
   If you enable IPX routing, an **IPX Profile Parameters** menu item becomes available. Select **IPX Profile Parameters** and press Return. The IPX Profile Parameters screen appears.

```
                          IPX Profile Parameters

        Remote IPX Network:                     00000000
        Path Delay:                             10
        NetBios Packet Forwarding:              Off

        Incoming Packet Filter Set...           <<NONE>>
        Outgoing Packet Filter Set...           <<NONE>>

        Incoming SAP Filter Set...              <<NONE>>
        Outgoing SAP Filter Set...              <<NONE>>


        Periodic RIP Timer:                     60
        Periodic SAP Timer:                     60




Configure IPX requirements for a remote network connection here.
```

6. Toggle or enter any IPX parameters you require and return to the Add Connection Profile screen by pressing Escape. For more information, see "IPX Setup" on page 10-1.

7. Select **ADD PROFILE NOW** and press Return. Your new connection profile will be added.

   If you want to view the connection profiles in your router, return to the WAN Configuration screen, and select **Display / Change Connection Profile**. The list of connection profiles is displayed in a scrolling pop-up screen.

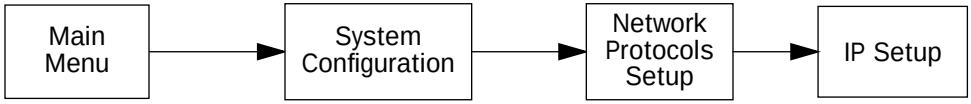


Network Address Translation guidelines

Observe the following guidelines when using Network Address Translation.

- The router can export only one local IP address per UDP/TCP port, so you can have just one machine available for a given service, such as one FTP server. However, some services, such as Web servers (www-http servers), allow you to change the UDP/TCP port on both the server and client. With two different UDP/TCP ports exported, you can have Web servers on two different IP hosts.
- If you will be using multiple connection profiles, define the remote IP address of the most accessible profile, such as that for your ISP, to the default IP gateway in the TCP/IP settings on users' workstations. That way, IP traffic not intended specifically for any of the remote networks will be routed through this "preferred" profile.
- Associate your primary Domain Name Server (DNS) with whichever profile is more accessible. If you choose for neither profile to be "dial-on-demand," you can associate a secondary DNS with the other profile. See "IP setup," below, for more information on these settings.

IP setup



The IP Setup options screen is where you configure the Ethernet side of the Netopia R5000 Series Router. The information you enter here controls how the router routes IP traffic.

Consult your network administrator or Internet service provider to obtain the IP setup information (such as the Ethernet IP address, Ethernet subnet mask, default IP gateway and Primary Domain Name Server IP address) you will need before changing any of the settings in this screen. Changes made in this screen will take effect only after the Netopia R5000 Series Router is reset.

To go to the IP Setup options screen, from the Main Menu, select **System Configuration**, then **Network Protocols Setup**, and then **IP Setup**.

The IP Setup screen appears.

```
                              IP Setup

        Ethernet IP Address:                192.128.117.162
        Ethernet Subnet Mask:               255.255.255.0
        Define Additional Subnets...

        Default IP Gateway:                 192.128.117.163

        Primary Domain Name Server:         0.0.0.0
        Secondary Domain Name Server:       0.0.0.0
        Domain Name:

        Receive RIP:                        Both
        Transmit RIP:                       v2 (multicast)
        Static Routes...

        Address Serving Setup...
        Exported Services...
        Filter Sets...
```

Follow these steps to configure IP setup for your Netopia R5000 Series Router:

- Select **Ethernet IP Address** and enter the IP address for the Netopia R5000 Series's Ethernet port.
- Select **Ethernet Subnet Mask** and enter the subnet mask for the Ethernet IP address that you entered in the last step.
- For unlimited-user models, if you desire multiple subnets select **Define Additional Subnets**. Twelve-user models do not offer this option. If you select this item you will be taken to the IP Subnets screen. This screen allows you to define IP addresses and masks for additional subnets. See "IP subnets" on page 9-16 for details.

The Netopia R5000 Series Router supports multiple IP subnets on the Ethernet interface. You may want to configure multiple IP subnets to service more hosts than are possible with your primary subnet. It is not always possible to obtain a larger subnet from your ISP. For example, if you already have a full Class C subnet, your only option is multiple Class C subnets, since it is virtually impossible to justify a Class A or Class B assignment. This assumes that you are not using NAT.

If you are using NAT, you can use the reserved Class A or Class B subnet.

- Select **Default IP Gateway** and enter the IP address for a default gateway. This can be the address of any major router accessible to the Netopia R5000 Series Router.

  A default gateway should be able to successfully route packets when the Netopia R5000 Series Router cannot recognize the intended recipient's IP address. A typical example of a default gateway is the ISP's router.

- Select **Primary Domain Name Server** and enter the IP address for a domain name server. The domain name server matches the alphabetic addresses favored by people (for example, robin.hood.com) to the IP addresses actually used by IP routers (for example, 163.7.8.202).

- If a secondary DNS server is available, select **Secondary Domain Name Server** and enter its IP address. The secondary DNS server is used by the Netopia R5000 Series Router when the primary DNS server is inaccessible. Entering a secondary DNS is useful but not necessary.

- Select **Domain Name** and enter your network's domain name (for example, netopia.com). Netopia strongly recommends that you enter a domain name.

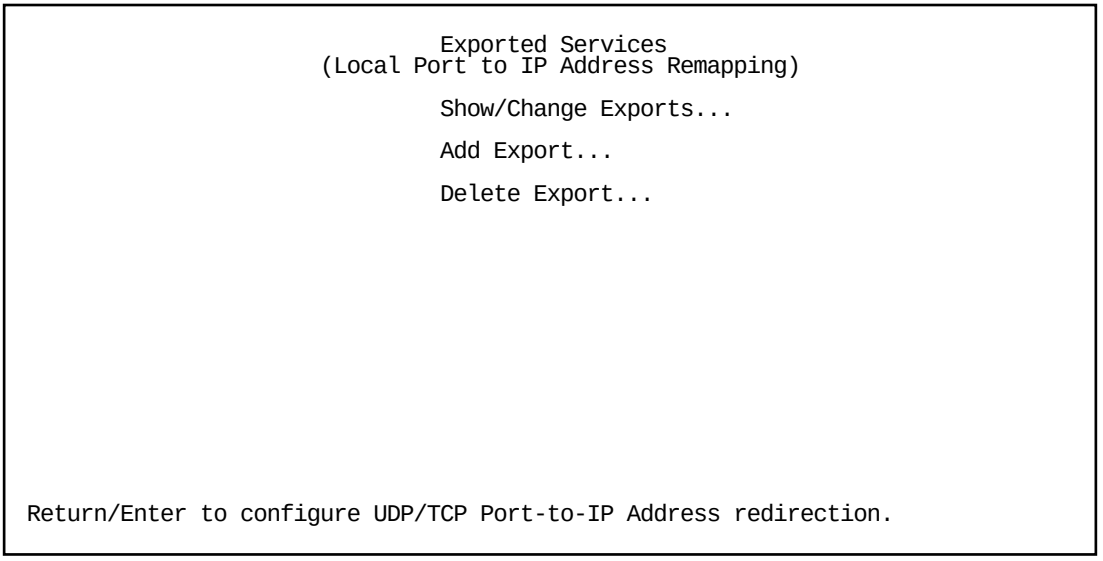
- Routing Information Protocol (RIP) is needed if there are IP routers on other segments of your Ethernet network that the Netopia R5000 Series Router needs to recognize. If this is the case select **Receive RIP** and select **v1**, **v2**, or **Both** from the pop-up menu. With Receive RIP set to v1, the Netopia R5000 Series Router's Ethernet port will accept routing information provided by RIP packets from other routers that use the same subnet mask. Set to v2, the Netopia R5000 Series Router will accept routing information provided by RIP packets from other routers that use different subnet masks. Set to Both, the Router will accept information from either RIP v1 or v2 routers.

- If you want the Router to advertise its routing table to other routers via RIP, select **Transmit RIP** and select **v1**, **v2 (broadcast)**, or **v2 (multicast)** from the pop-up menu. With Transmit RIP v1 selected, the Router will generate RIP packets only to other RIP v1 routers. With Transmit RIP v2 (broadcast) selected, the Netopia R5000 Series Router will generate RIP packets to all other hosts on the network. With Transmit RIP v2 (multicast) selected, the Router will generate RIP packets only to other routers capable of recognizing RIP v2 packets.

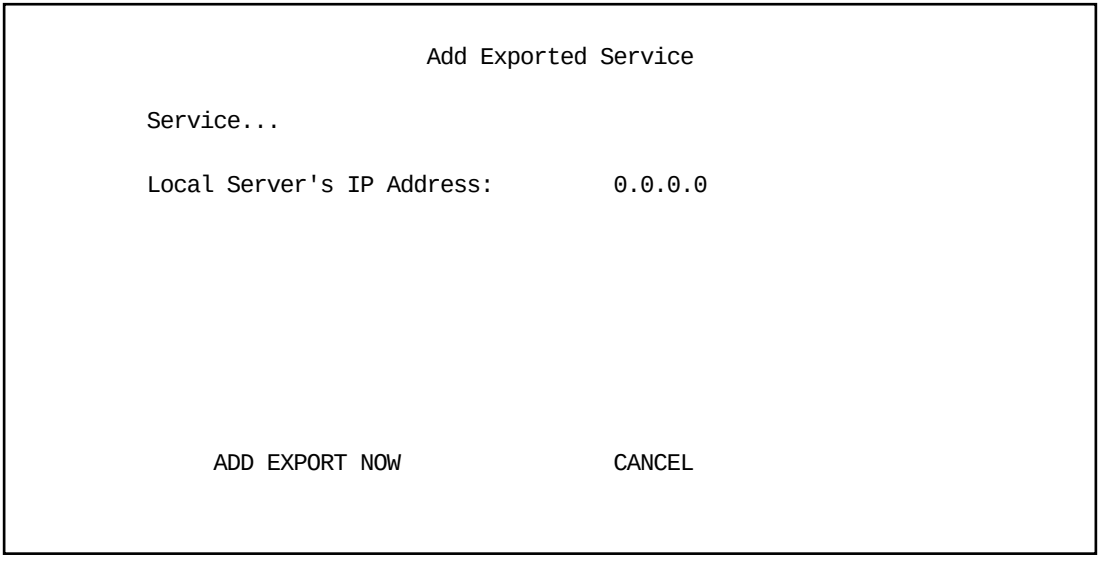
- Select **Static Routes** to manually configure IP routes. See the section "Static routes," below.

- If you select **Address Serving Setup** you will be taken to the IP Address Serving screen (see "IP address serving" on page 9-22. Since no two hosts can use the same IP address at the same time, make sure that the addresses distributed by the Router, and those that are manually configured are not the same. Each method of distribution must have its own exclusive range of addresses to draw from.

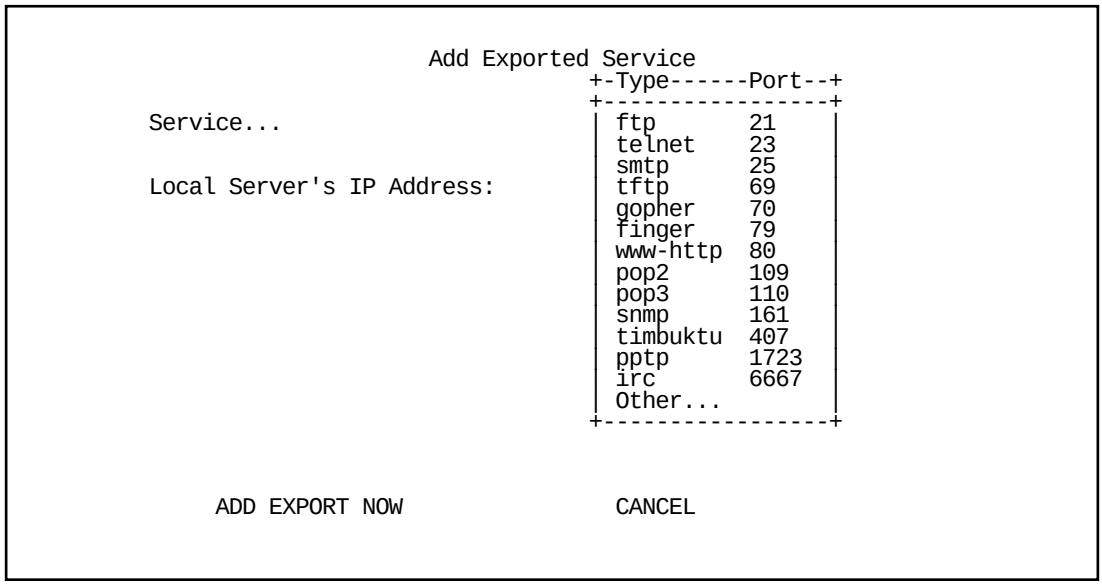
- Select **Exported Services.** The Exported Services screen appears with three options: Show/Change Exports, Add Export, and Delete Export.



- Select **Add Export**. The Add Exported Service screen appears.



- Select **Service**. A pop-up menu of services and ports appears.



8. Select any of the services/ports and press Return to associate it with the address of a server on your local area network. For example, if you select **www-http 80**, press Return, and type **10.0.0.2**, the Netopia R5000 Series Router redirects any incoming traffic destined for a Web server to address 10.0.0.2.

   Some services such as Timbuktu require the export of multiple TCP ports. When you associate Timbuktu with a local server (or Timbuktu host) all of the major Timbuktu services are exported, i.e., Observe, Control, Send, and Exchange.

Note: If the TCP port of a service you want to use is not listed, you can add it by selecting **Other...** on the pop-up menu.

Press Escape when you are finished configuring exported services. You are returned to the IP Setup screen.

```
                              IP Setup

Ethernet IP Address:                  192.128.117.162
Ethernet Subnet Mask:                 255.255.255.0
Define Additional Subnets...

Default IP Gateway:                   192.128.117.163

Primary Domain Name Server:           0.0.0.0
Secondary Domain Name Server:         0.0.0.0
Domain Name:

Receive RIP:                          Both
Transmit RIP:                         v2 (multicast)
Static Routes...

Address Serving Setup...
Exported Services...
Filter Sets...
```

- If you select **Filter Sets** you will be taken directly to the screen for configuring IP packet filters. For information see "About filters and filter sets," beginning on page 13-4.

IP subnets

The IP Subnets screen allows you to configure up to eight Ethernet IP subnets on unlimited-user models, one "primary" subnet and up to seven secondary subnets, by entering IP address/subnet mask pairs:

```
                          IP Subnets

      IP Address          Subnet Mask
      ---------------     --------------
#1:   192.128.117.162     255.255.255.0
#2:   0.0.0.0             0.0.0.0
#3:
#4:
#5:
#6:
#7:
#8:
```

Note: You need not use this screen if you have only a single Ethernet IP subnet. In that case, you can continue to enter or edit the IP address and subnet mask for the single subnet on the IP Setup screen.

This screen displays up to eight rows of two editable columns, preceded by a row number between one and eight. If you have eight subnets configured, there will be eight rows on this screen. Otherwise, there will be one more row than the number of configured subnets. The last row will have the value 0.0.0.0 in both the IP address and subnet mask fields to indicate that you can edit the values in this row to configure an additional subnet. All eight row labels are always visible, regardless of the number of subnets configured.

- To add an IP subnet, enter the Netopia R5000 Series Router's IP address on the subnet in the **IP Address** field in a particular row and the subnet mask for the subnet in the **Subnet Mask** field in that row.

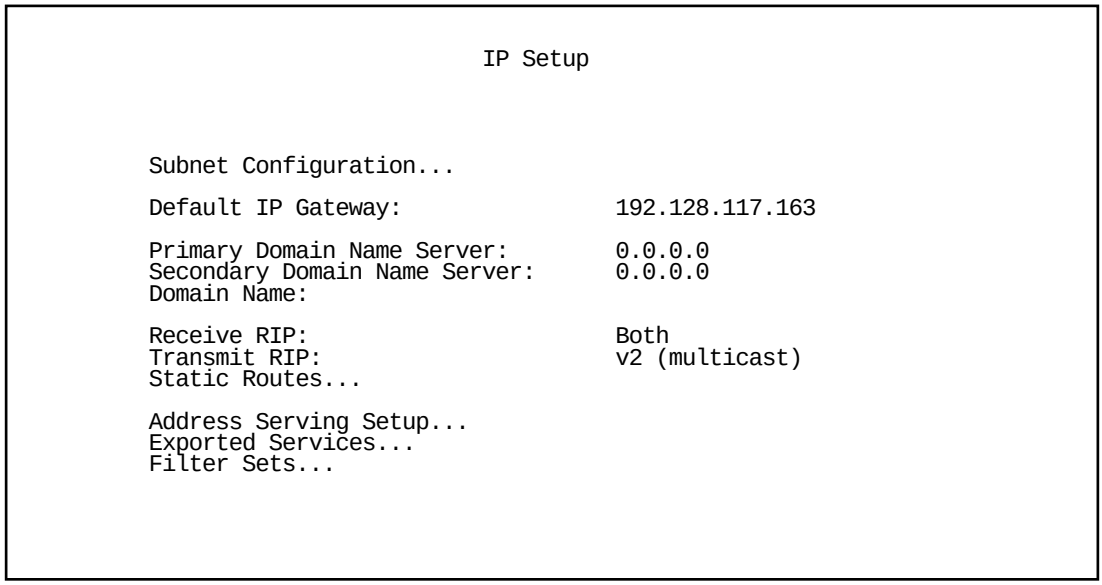
  For example:

```
                        IP Subnets

      IP Address          Subnet Mask
      ---------------     --------------
#1:   192.128.117.162     255.255.255.0
#2:   192.128.152.162     255.255.0.0
#3:   0.0.0.0             0.0.0.0
#4:
#5:
#6:
#7:
#8:
```

- To delete a configured subnet, set both the IP address and subnet mask values to 0.0.0.0, either explicitly or by clearing each field and pressing Return to commit the change. When a configured subnet is deleted, the values in subsequent rows adjust up to fill the vacant fields.

Note that the subnets configured on this screen are tied to the address serving pools configured on the IP Address Pools screen, and that changes on this screen may affect the IP Address Pools screen. In particular, deleting a subnet configured on this screen will delete the corresponding address serving pool, if any, on the IP Address Pools screen.

If you have configured multiple Ethernet IP subnets, the IP Setup screen changes slightly:



The IP address and Subnet mask items are hidden, and "Define Additional Subnets..." becomes **Subnet Configuration...**. If you select **Subnet Configuration**, you will return to the IP Subnets screen that allows you to define IP addresses and masks for additional Ethernet IP subnets.

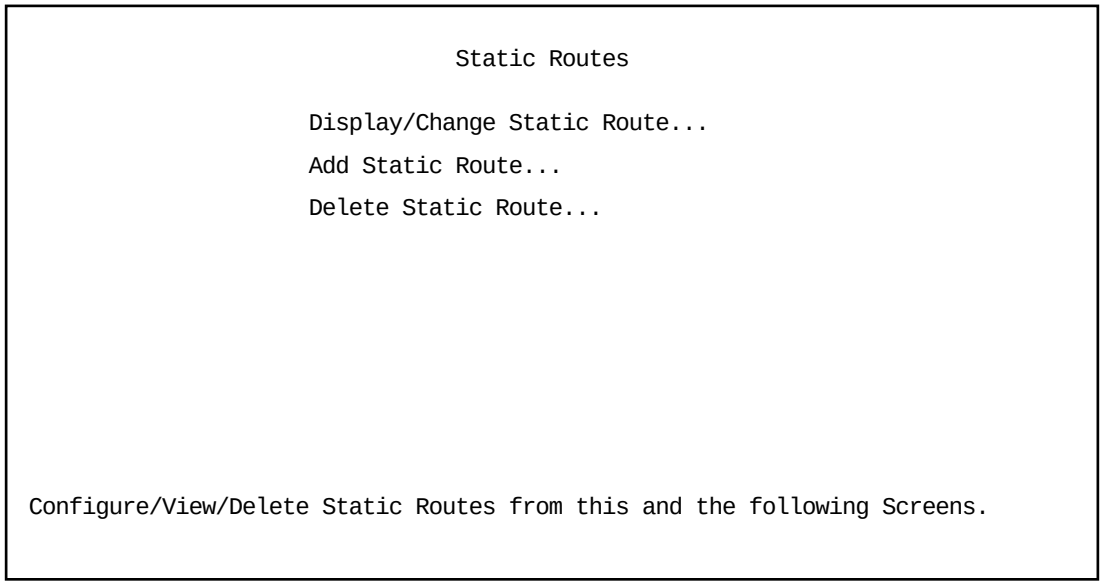
Static routes

Static routes are IP routes that are maintained manually. Each static route acts as a pointer that tells the Netopia R5000 Series Router how to reach a particular network. However, static routes are used only if they appear in the IP routing table, which contains all of the routes used by the Netopia R5000 Series Router (see "IP routing table" on page 12-9).

Static routes are helpful in situations where a route to a network must be used and other means of finding the route are unavailable. For example, static routes are useful when you cannot rely on RIP.

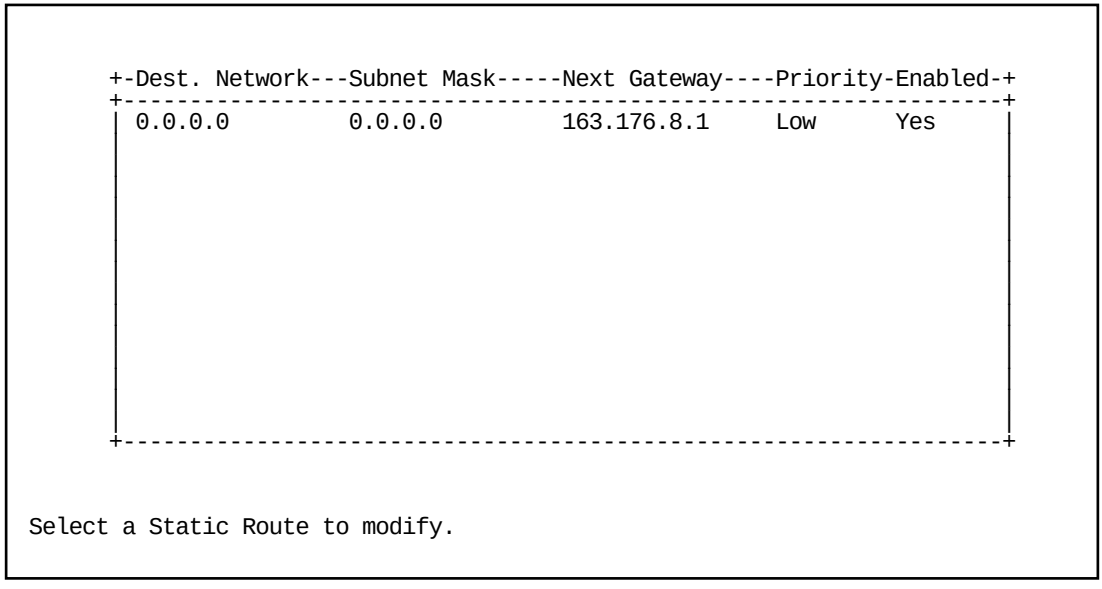
To go to the Static Routes screen, select **Static Routes** in the IP Setup screen and press Return.

The Static Routes screen will appear.



Viewing static routes

To display a view-only table of static routes, select **Display / Change Static Route**. The table shown below will appear.



The table has the following columns:

Dest. Network: The network IP address of the destination network.

Subnet Mask: The subnet mask associated with the destination network.

Next Gateway: The IP address of the router that will be used to reach the destination network.

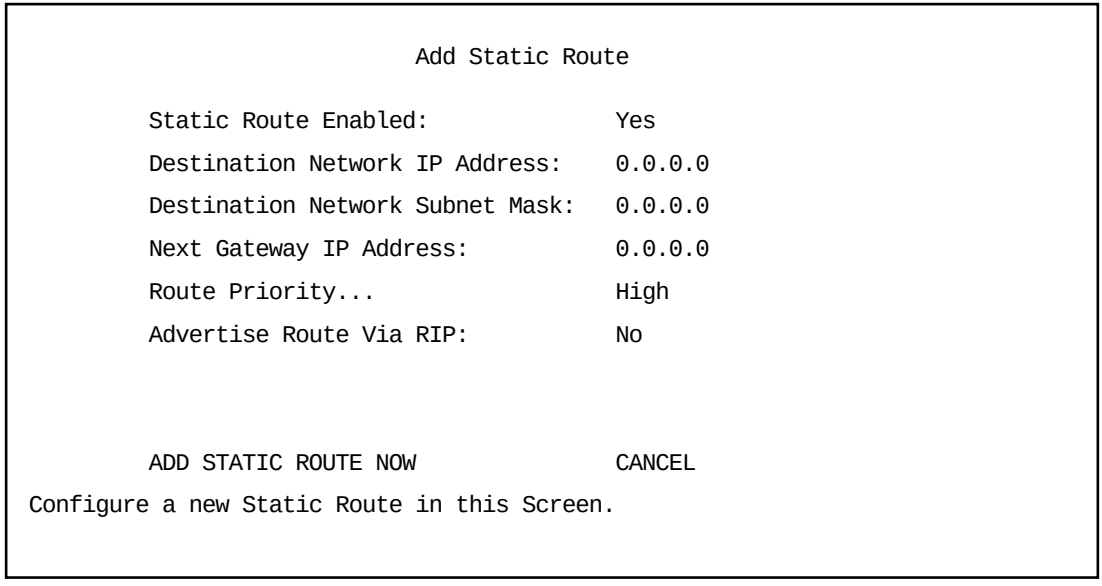
Priority: An indication of whether the Netopia R5000 Series Router will use the static route when it conflicts with information received from RIP packets.

Enabled: An indication of whether the static route should be installed in the IP routing table.

To return to the Static Routes screen, press Escape.

Adding a static route

To add a new static route, select **Add Static Route** in the Static Routes screen. The Add Static Route screen will appear.



- To install the static route in the IP routing table, select **Static Route Enabled** and toggle it to **Yes**. To remove the static route from the IP routing table, select **Static Route Enabled** and toggle it to **No**.
- Be sure to read the rules on the installation of static routes in the IP routing table. See "Rules of static route installation" on page 9-21.
- Select **Destination Network IP Address** and enter the network IP address of the destination network.
- Select **Destination Network Subnet Mask** and enter the subnet mask used by the destination network.
- Select **Next Gateway IP Address** and enter the IP address for the router that the Router will use to reach the destination network. This router does not necessarily have to be part of the destination network, but it must at least know where to forward packets destined for that network.
- Select **Route Priority** and choose **High** or **Low**. **High** means that the static route takes precedence over RIP

information; **Low** means that the RIP information takes precedence over the static route.

- If the static route conflicts with a connection profile, the connection profile will always take precedence.
- To make sure that the static route is known only to the Netopia R5000 Series Router, select **Advertise Route Via RIP** and toggle it to **No**. To allow other RIP-capable routers to know about the static route, select **Advertise Route Via RIP** and toggle it to **Yes**. When **Advertise Route Via RIP** is toggled to **Yes**, a new item called **RIP Metric** appears below **Advertise Route Via RIP**.

  With RIP Metric you set the number of routers, from 1 to 15, between the sending router and the destination router. The maximum number of routers on a packet's route is 15. Setting **RIP Metric** to **1** means that a route can involve 15 routers, while setting it to **15** means a route can only involve one router.
- Select **ADD STATIC ROUTE NOW** to save the new static route, or select **CANCEL** to discard it and return to the Static Routes screen.
- Up to 16 static routes can be created, but one is always reserved for the default gateway, which is configured using either Easy Setup or the IP Setup screen in system configuration.

Modifying a static route

To modify a static route, in the Static Routes screen select **Display / Change Static Route** to display a table of static routes.

Select a static route from the table and go to the Change Static Route screen. The parameters in this screen are the same as the ones in the Add Static Route screen (see "Adding a static route" on page 9-20).

Deleting a static route

To delete a static route, in the Static Routes screen select **Delete Static Route** to display a table of static routes. Select a static route from the table and press Return to delete it. To exit the table without deleting the selected static route, press Escape.

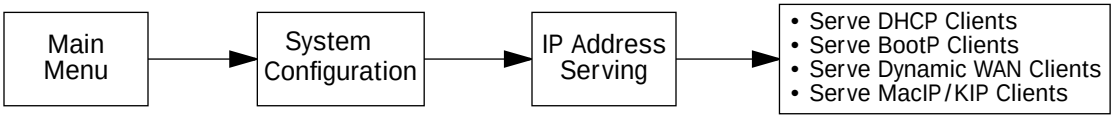
Rules of static route installation

The Netopia R5000 Series Router applies certain rules before installing enabled static routes in the IP routing table. An enabled static route will not be installed in the IP routing table if any of the following conditions are true:

- The static route's **Next Gateway IP Address** matches the IP address used by a connection profile or the Router's Ethernet port.
- The static route's **Next Gateway IP Address** matches an IP address in the range of IP addresses being distributed by MacIP or DHCP.
- The static route's **Next Gateway IP Address** is determined to be unreachable by the Netopia R5000 Series Router.
- The static route's route information conflicts with a connection profile's route information.
- The connection profile associated with the static route is set for dial-in connections only, and there is no incoming call connected to that connection profile.
- The connection profile associated with the static route has a disabled dial-on-demand setting, and there is no current connection using that connection profile.

A static route that is already installed in the IP routing table will be removed if any of the conditions listed above become true for that static route. However, an enabled static route is automatically reinstalled once the conditions listed above are no longer true for that static route.

IP address serving



In addition to being a router, the Netopia R5000 Series Router is also an IP address server. There are four protocols it can use to distribute IP addresses.

- The first, called Dynamic Host Configuration Protocol (DHCP), is widely supported on PC networks, as well as Apple Macintosh computers using Open Transport and computers using the UNIX operating system. Addresses assigned via DHCP are "leased" or allocated for a short period of time; if a lease is not renewed, the address becomes available for use by another computer. DHCP also allows most of the IP parameters for a computer to be configured by the DHCP server, simplifying setup of each machine.
- The second, called BootP (also known as Bootstrap Protocol), is the predecessor to DHCP and allows older IP hosts to obtain most of the information that a DHCP client would obtain. However, in contrast, BootP address assignments are "permanent" since there is no lease renewal mechanism in BootP.
- The third protocol, called Dynamic WAN, is part of the PPP/MP suite of wide area protocols used for WAN connections. It allows remote terminal adapters and NAT-enabled routers to be assigned a temporary IP address for the duration of their connection.
- The fourth protocol, called MacIP, is used only for computers on AppleTalk networks. MacIP provides a protocol translation (or gateway) function between IP and AppleTalk as well as an IP address assignment mechanism. Like DHCP, MacIP address assignments are normally temporary, although you can also use static IP addresses with MacIP.

Since no two hosts can use the same IP address at the same time, make sure that the addresses distributed by the Router and those that are manually configured are not the same. Each method of distribution must have its own exclusive range of addresses to draw from.

Go to the System Configuration screen. Select **IP Address Serving** and press Return. The IP Address Serving screen will appear.

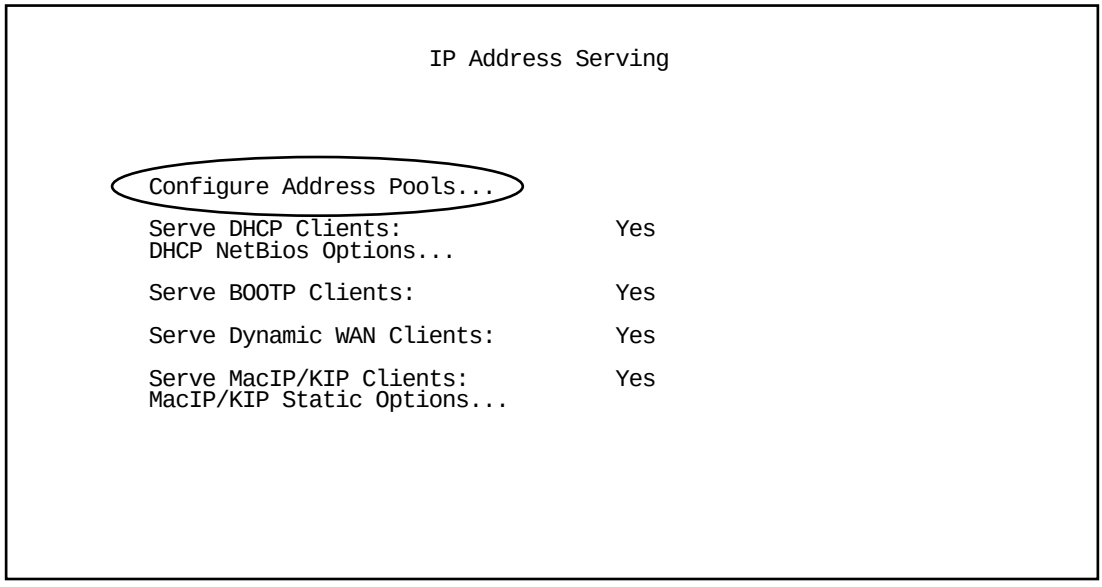
```
                        IP Address Serving

Number of Client IP Addresses:     5
1st Client Address:                176.163.222.10
Client Default Gateway...          176.163.222.1


Serve DHCP Clients:                Yes
DHCP NetBios Options...

Serve BOOTP Clients:               Yes



Serve MacIP/KIP Clients:           Yes
MacIP/KIP Static Options...
```

Follow these steps to configure IP Address Serving:

- If you enabled IP Address Serving, then DHCP, BootP clients, Dynamic WAN clients, and MacIP/KIP clients (if you have the AppleTalk kit installed) are automatically enabled.
- Select **Number of Client IP Addresses** and enter the total number of contiguous IP addresses that the Netopia R5000 Series Router will distribute to the client machines on your local area network. Twelve-user models are limited to twelve IP addresses.
- In the screen example shown above, five Client IP addresses have been allocated.
- Select **1st Client Address** and enter the first client IP address that you will allocate to your first client machine. For instance, on your local area network you may want to first figure out which machines are going to be allocated specific static IP addresses so that you can determine the pool of IP addresses that you will be serving addresses from via DHCP, BootP, Dynamic WAN, and/or MacIP.

  Example: Your ISP has given your Netopia R5000 Series Router the IP address 192.168.6.137, with a subnet mask of 255.255.255.248. The subnet mask allocated will give you six IP addresses to use when connecting to the ISP over the Internet (for more information on IP addressing refer to Appendix B, "Understanding IP Addressing."). Your address range will be from **.137-.143**. In this example you would enter **192.168.6.138** as the 1st Client Address, since the router itself must have an IP address.
- To enable DHCP, select **Serve DHCP Clients** and toggle it to **Yes**. DHCP serving is automatic when IP Address Serving is enabled.

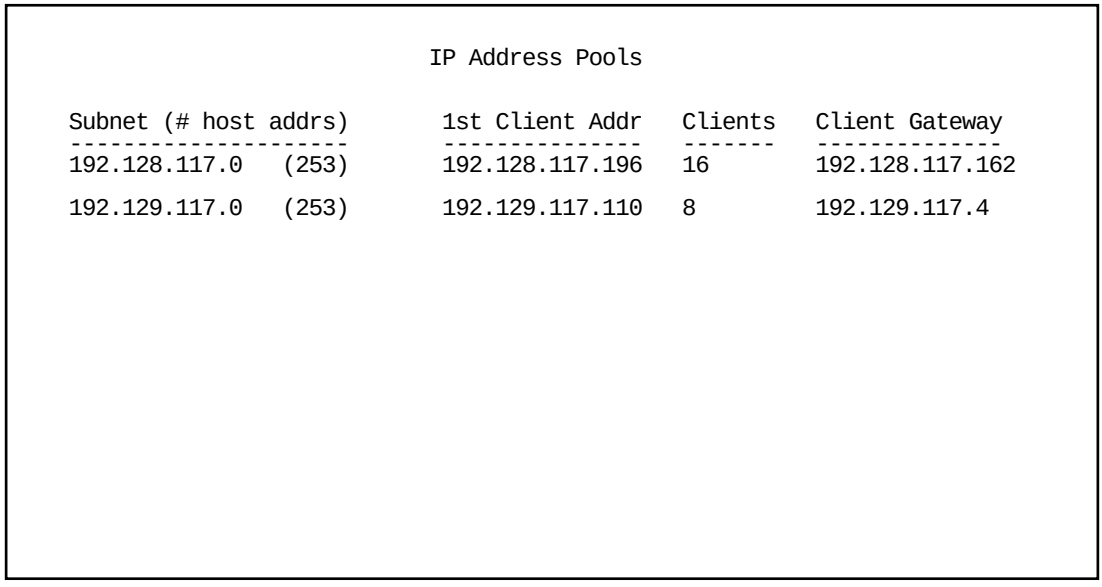
If you have configured multiple Ethernet IP subnets, the appearance of the IP Address Serving screen is altered slightly:



The first three menu items are hidden, and **Configure Address Pools...** appears instead. If you select **Configure Address Pools...** you will be taken to the IP Address Pools screen that allows you to configure an address serving pool for each of the configured Ethernet IP subnets. See "IP Address Pools" on page 9-25.

IP Address Pools

The IP Address Pools screen allows you to configure a separate IP address serving pool for each of up to eight configured Ethernet IP subnets:



This screen consists of between two and eight rows of four columns each. There are exactly as many rows as there are Ethernet IP subnets configured on the IP Subnets screen.

- The **Subnet (# host addrs)** column is non-selectable and non-editable. It indicates the network address of the Ethernet IP subnet for which an address pool is being configured and the number of host addresses available on the subnet. The network address is equal to the router's IP address on the subnet bitwise-ANDed with the subnet mask. The host address count is equal to the subnet size minus three, since one address is reserved for the network address, one for the subnet broadcast address, and one for the router's interface address on the subnet.

  You can edit the remaining columns in each row.

- The **1st Client Addr** and **Clients** columns allow you to specify the base and extent of the address serving pool for a particular subnet. Entering 0.0.0.0 for the first client address or 0 for the number of clients indicates that no addresses will be served from the corresponding Ethernet IP subnet.

- The **Client Gateway** column allows you to specify the default gateway address that will be provided to clients served an address from the corresponding pool. The value defaults to the Router's IP address on the corresponding subnet (or the Netopia R5000 Series Router's default gateway, if that gateway is located on the subnet in question). You can override the value by entering any address that is part of the subnet.

  DHCP, BootP, dynamic WAN, and dynamic MacIP clients may receive an address from any one of the address serving pools configured on this screen. Static MacIP clients are not "served" addresses, but must be manually configured with addresses from within the specific range of addresses reserved for that purpose on the MacIP (KIP) Forwarding Setup screen. See "MacIP (KIP forwarding) setup" on page 9-29.

Numerous factors influence the choice of served address. It is difficult to specify the address that will be served to a particular client in all circumstances. However, when the address server has been configured, and the clients involved have no prior address serving interactions, the Netopia R5000 Series Router will generally serve the first unused address from the first address pool with an available address. The Netopia R5000 Series Router starts from the pool on the first row and continues to the pool on the last row of this screen.

Once the address server and/or the clients have participated in address serving transactions, different rules apply:

- When requesting an address, a client will often suggest an address to be assigned, such as the one it was last served. The Netopia R5000 Series Router will attempt to honor this request if the address is available. The client stores this address in non-volatile storage, for example, on disk, and the specific storage method/location differs depending on the client operating system.
- When requesting an address, a client may provide a client identifier, or, if it does not, the Router may construct a pseudo-client identifier for the client. When the client subsequently requests an address, the Router will attempt to serve the address previously associated with the pseudo-client identifier. This is normally the last address served to the client.
- Otherwise, the Netopia will select the least-recently used available address, starting from the first address in the first pool and ending with the last address in the last pool.

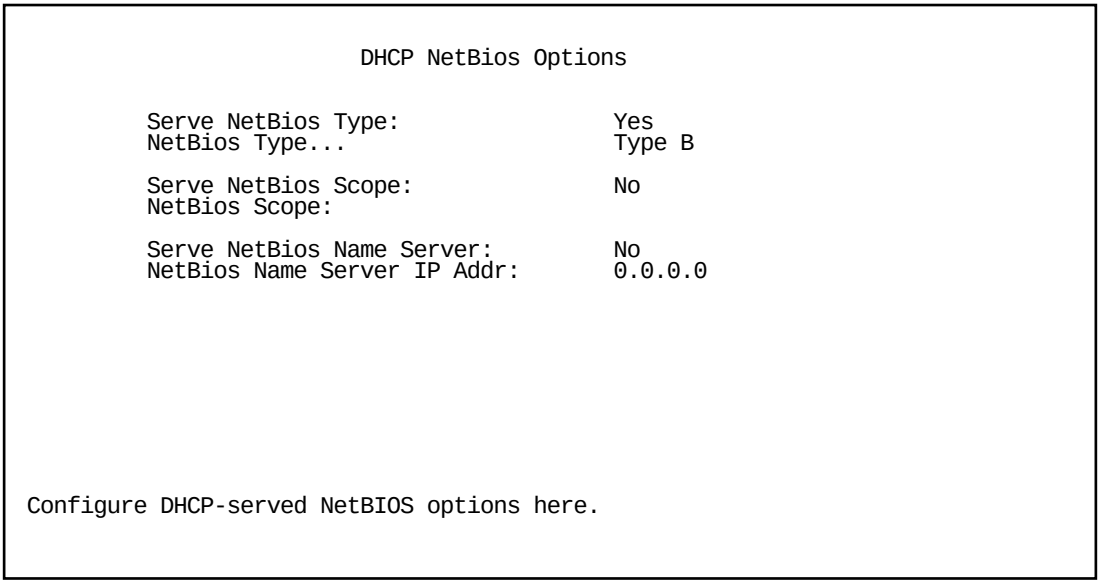
Note that the address serving pools on this screen are tied to the IP subnets configured on the IP Subnets screen. Changes to the IP Subnets screen may affect the IP Address Pools. In particular, deleting a subnet on the IP Subnets screen will delete the corresponding address serving pool, if any, on this screen.

DHCP NetBIOS Options

If your network uses NetBIOS, you can enable the Netopia R5000 Series Router to use DHCP to distribute NetBIOS information.

NetBIOS stands for Network Basic Input/Output System. It is a layer of software originally developed by IBM and Sytek to link a network operating system with specific hardware. NetBIOS has been adopted as an industry standard. It offers LAN applications a variety of "hooks" to carry out inter-application communications and data transfer. Essentially, NetBIOS is a way for application programs to talk to the network. To run an application that works with NetBIOS, a non-IBM network operating system or network interface card must offer a NetBIOS emulator. Many vendors either provide a version of NetBIOS to interface with their hardware or emulate its transport layer communications services in their network products. A NetBIOS emulator is a program provided by NetWare clients that allow workstations to run applications that support IBM's NetBIOS calls.

- Select **DHCP NetBios Options** and press Return. The DHCP NetBIOS Options screen appears.



- To serve DHCP clients with the type of NetBIOS used on your network, select **Serve NetBios Type** and toggle it to **Yes**.

- From the **NetBios Type** pop-up menu, select the type of NetBIOS used on your network.

```
                    DHCP NetBios Options

                                          +--------+
Serve NetBios Type:                       +--------+
NetBios Type...                           | Type B |
                                          | Type P |
Serve NetBios Scope:                      | Type M |
NetBios Scope:                            | Type H |
                                          +--------+
Serve NetBios Name Server:                  No
NetBios Name Server IP Addr:                0.0.0.0
```

- To serve DHCP clients with the NetBIOS scope, select **Serve NetBios Scope** and toggle it to **Yes**.

  Select **NetBios Scope** and enter the scope.

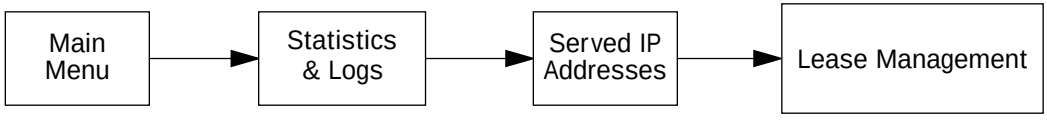
- To serve DHCP clients with the IP address of a NetBIOS name server, select **Serve NetBIOS Name Server** and toggle it to **Yes**.

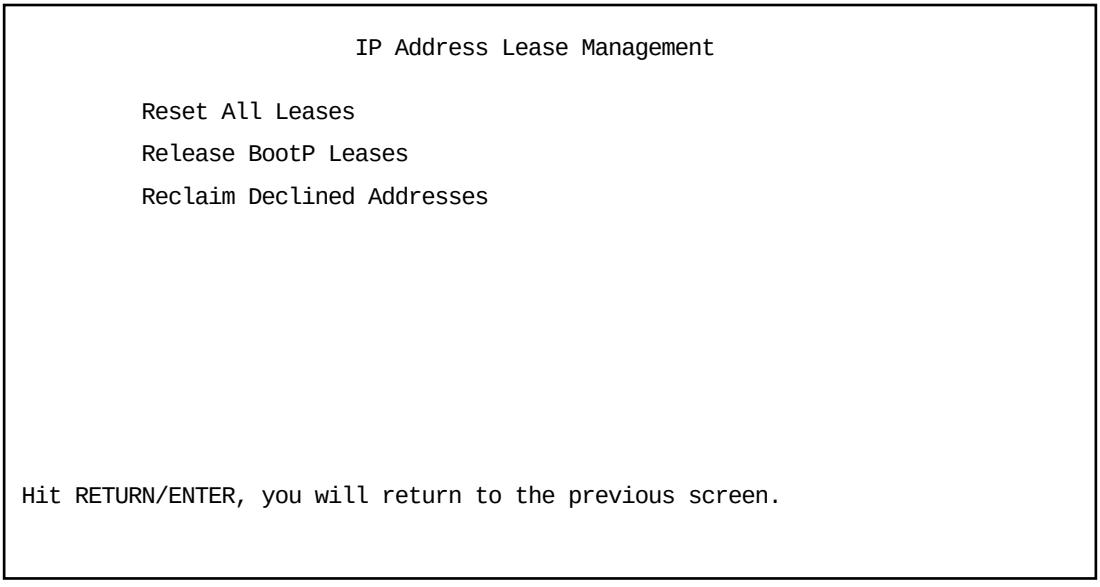
  Select **NetBios Name Server IP Addr** and enter the IP address for the NetBIOS name server.

  You are now finished setting up DHCP NetBIOS Options. To return to the IP Address Serving screen press Escape.

- To enable BootP's address serving capability, select **Serve BOOTP Clients** and toggle to **Yes**.

  Note: Addresses assigned through BootP are permanently allocated from the IP Address Serving pool until you release them. To release these addresses, navigate back to the Main Menu, then Statistics & Logs, Served IP Addresses, and select **Lease Management**. Press Return.





Select **Release BootP Leases** and press Return.

MacIP (KIP forwarding) setup

When hosts using AppleTalk (typically those using LocalTalk) are not directly connected to an IP network (usually an Ethernet), they must use a MacIP (AppleTalk–IP) gateway.

The optional Netopia AppleTalk feature enhancement kit provides for this service. A MacIP gateway converts network traffic into the correct format for AppleTalk or IP, depending on the traffic's destination. The MacIP gateway can also distribute IP addresses to AppleTalk computers on the network.

Note: Macintosh computers that have LocalTalk or EtherTalk selected in the MacTCP control panel, or "AppleTalk (MacIP)" selected in the TCP/IP control panel, must use the MacIP gateway to communicate with the Internet or any other IP network. Users should point their MacTCP or TCP/IP control panel to look in the LocalTalk zone for the MacIP server. Macintosh computers that have Ethernet selected in the MacTCP or TCP/IP control panel can do their own AppleTalk–IP conversions.

Setting up MacIP involves choosing MacIP dynamic address serving and then configuring that type. KIP forwarding is simply a method for distributing IP addresses to AppleTalk clients.

- In the IP Address Serving screen, select **Serve Mac IP/KIP Clients** and toggle to **Yes** to enable MacIP/KIP address serving capability. This option is automatically enabled if the AppleTalk kit is installed and IP Address Serving is enabled.
- Select **MacIP/KIP Static Options** and press Return. The MacIP/KIP Forwarding screen appears.

The MacIP (KIP) Forwarding Setup screen tells the Router how many static addresses to allocate for MacIP/KIP clients. The addresses must fall within the address pool from the previous screen.

- Enter the number of static MacIP addresses to reserve.

  Note that the address pool IP range is listed for your referral in this screen.

```
                          MacIP (KIP) Forwarding Setup

 This screen tells the Netopia how many static addresses to allocate for
 MacIP/KIP clients. The addresses must fall within one of the address pools
 from the previous screen.

         Number of Static Addresses:        0

         First Static Client Address:       0.0.0.0









Enter the number of static MacIP addresses to reserve here.
Reserve static MacIP addresses for KIP Forwarding here.
```

You have finished your IP setup.

Chapter 10

IPX Setup

Internetwork Packet Exchange (IPX) is the network protocol used by Novell NetWare networks. This chapter shows you how to configure the Netopia R5000 Series Router for routing data using IPX. You also learn how to configure the router to serve IPX network addresses.

This section covers the following topics:

IPX features

The Netopia R5000 Series Router supports the following IPX features:

- IPX RIP and SAP
- NetBIOS broadcast packet forwarding (IPX type 20)
- IPX packet filtering definable by source and destination IPX address and socket number for added security
- IPX SAP filtering to aid in optimizing WAN bandwidth
- Dial-on-demand features:
  - Spoofing of IPX keep-alive, SPX, and server serialization packets
  - Configurable RIP/SAP timers on connection profiles

IPX definitions

This section defines IPX-related protocols such as RIP, SAP, and NetBIOS, in addition to other related terms. See the next section for setup instructions.

Internetwork Packet Exchange (IPX)

IPX is a datagram, connectionless protocol that Novell adapted from Xerox Network System's (XNS's) Internet Datagram Protocol (IDP). IPX is dynamically routed, and the routing architecture works by "learning" network addressing automatically.

IPX address

An IPX address consists of a network number, a node number, and a socket number. An IPX network number is composed of eight hexadecimal digits. The network number must be the same for all nodes on a particular physical network segment. The node number is composed of twelve hexadecimal digits and is usually the hardware address of the interface card. The node number must be unique inside the particular IPX network. Socket numbers correspond to the particular service being accessed.

Socket

A socket in IPX is the equivalent of a port in TCP/IP. Sockets route packets to different processes within a single node. Novell has reserved several sockets for use in the NetWare environment:

Field Value	Packet Type	Description
00h	Unknown Packet Type	Used for all packets not classified by any other type
01h	Routing Information Packet	Unused for RIP packets
04h	Service Advertising Packet	Used for SAP packets
05h	Sequenced Packet	Used for SPX packets
11h	NetWare Core Protocol Packet	Used for NCP packets
14h	Propagated Packet	Used for Novell NetBIOS

Routing Information Protocol (RIP)

RIP, which was also derived from XNS, is a protocol that allows for the bidirectional transfer of routing tables and provides timing information (ticks), so that the fastest route to a destination can be determined. IPX routers use RIP to create and dynamically maintain databases of internetwork routing information. See "IPX routing tables" on page 10-5 for more information.

Service Advertising Protocol (SAP)

SAP is a protocol that provides servers and routers with a method for exchanging service information. Using SAP, servers advertise their services and addresses. Routers collect this information to dynamically update their routing tables and share it with other routers. These broadcasts keep all routers on the internetwork synchronized and provide real-time information on accessible servers on the internetwork.

The following is a list of common SAP server types:

Unknown	0000h
Print Queue	0003h
File Server	0004h
Job Server	0005h
Print Server	0007h
Archive Server	0009h
Remote Bridge Server	0024h
Advertising Print Server	0047h
Reserved Up To	8000h

NetBIOS

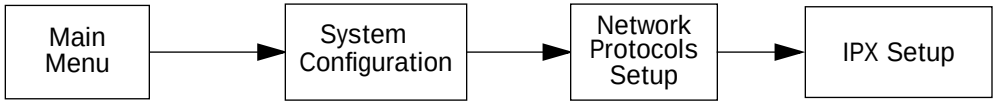
NetBIOS is a protocol that performs tasks related to the Transport and Session layers of the OSI model. It can operate over IPX using a special broadcast packet known as “IPX Packet type 20” to communicate with IPX NetBIOS servers.

IPX spoofing

The Netopia R5000 Series Router has several IPX features designed to restrict the traffic on the dial-up link when the unit is not sending or receiving IPX data. When the link is idle and a user is logged into a Novell server, the server will send keep-alive packets to ensure that the user is still there. If the link is idle, the keep-alive packets will be sent back to the server by the locally connected Netopia R5000 Series Router as though they came back from the user without bringing up the dial-up link.

SPX keep-alive packets are also treated in this manner. IPX RIP and SAP messages will not be sent if the link is down. Together, these features enable the user to remain connected to a Novell server or SPX peer without bringing up the dial-up link, except to send and receive actual user data.

IPX setup screen

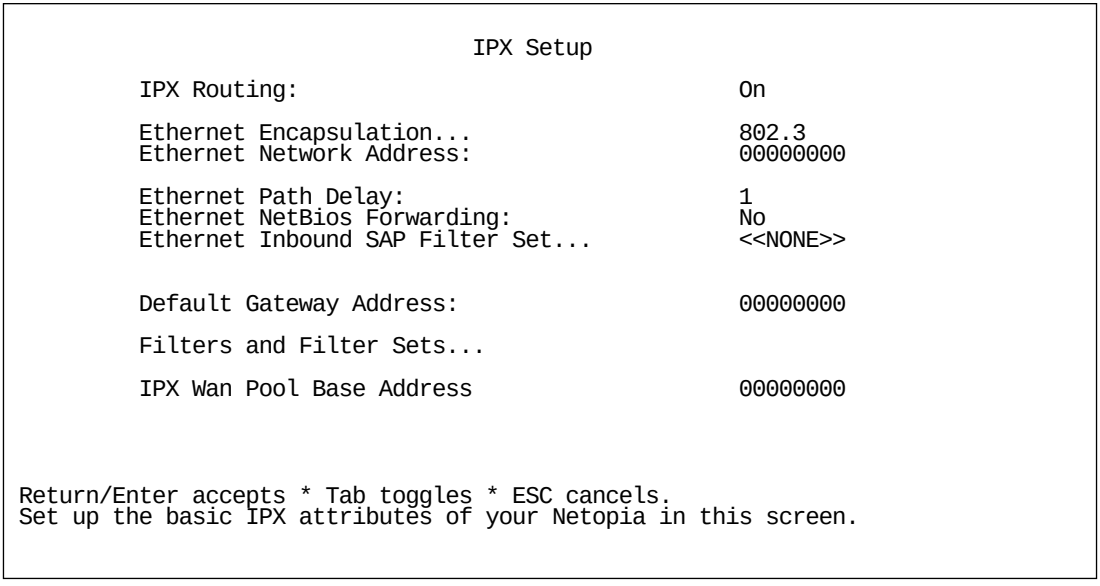


You will use the IPX Setup screen to configure the Ethernet side of the Netopia R5000 Series Router. The information you enter controls how the router routes IPX traffic.

Before changing any of the settings in this screen, consult your network administrator for the IPX setup information you will need. Changes made in this screen will take effect only after the Netopia R5000 Series Router is reset.

To go to the IPX Setup screen, from the Main Menu select **System Configuration** and then select **Network Protocols Setup** and then select **IPX Setup**.

Note: If you have completed Easy Setup, the information you have already entered will appear in the IP Setup options screen.



1. To enable IPX routing, select **IPX Routing**, toggle it to **On**, and press Return.
2. To change Ethernet encapsulation from the commonly used 802.3 standard, select **Ethernet Encapsulation** and choose a different encapsulation method.
3. Select **Ethernet Network Address** and enter the network address of the IPX network connected to the Netopia R5000 Series Router's Ethernet port.

   Note: If the Ethernet network address is set to zero, the router will attempt to learn the address from any configured IPX device on the Ethernet network or from the remote IPX network when a call is established.
4. To change the default path delay, select **Ethernet Path Delay** and enter a value (in ticks). This value is used to determine the port cost of using the Ethernet port in IPX RIP calculations.
5. To enable NetBIOS packet forwarding, select **Ethernet NetBios Forwarding** and toggle it to **Yes**. This parameter will determine whether IPX Packet type 20 packets are forwarded on the Ethernet interface. These packets are used by NetBIOS and some other applications.
6. Select **Ethernet Inbound SAP Filter Set** to filter incoming IPX SAP advertisements on the Ethernet. By attaching an incoming SAP filter on the Ethernet, you can restrict the number of SAP entries learned on a large IPX network to only those required by remote users connecting to the Netopia R5000 Series Router. An Ethernet SAP filter *must* be used with networks that have so many servers advertised that the Netopia R5000 Series Router would otherwise exhaust its internal memory storing server entries.

To attach a SAP filter set, first define the filter set using the **Filters and Filter Sets** option (see step 8 below). Then select the filter set from the **Ethernet Incoming SAP Filter Set** pop-up menu. To detach the filter set, select **Detach Filter Set**.

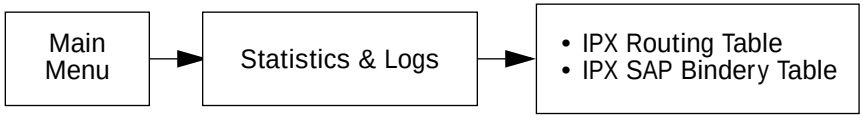
7. Select **Default Gateway Address** and enter the network address of the IPX network to which all packets of unknown destination address should be routed.

   Note: The default gateway address is usually set up to match the IPX Address in your network connection profile.

8. To configure filters and filter sets, select **Filters and Filter Sets** and go to the IPX filters and filter sets screens. For information on how to configure IPX filters and filter sets, see "IPX filters" on page 13-23.

9. Select **IPX Wan Pool Base Address** and enter the first IPX network address to be allocated to requesting IPX WAN clients. The base address you enter must not conflict with other IPX networks assigned to your IPX internet.

IPX routing tables



IPX routing tables provide information on current IPX routes and services.

To go to the IPX Routing Table screen, select **IPX Routing Table** in the Statistics & Logs screen. This table shows detailed information about current IPX network routes.

```
                                IPX Routing Table

 Net Addr-Hops-Ticks-Type--Status-Interface--------------via Router------------
 ----------------------------------SCROLL UP-----------------------------------
00000020   2      3 RIP   Active Ethernet          00000120:00000c465c2f
00000030   2     12 RIP   Active Ethernet          00000120:00000c465c2f
00000033   4     14 RIP   Active Ethernet          000000120:00000c465c2f
00000100   2      7 RIP   Active Ethernet          00000120:00000c465c2f
00000110   1      1 RIP   Active Ethernet          00000120:00000c465c2f


--------------------------------SCROLL DOWN-----------------------------
UPDATE
```

To go to the IPX SAP Bindery Table screen, select **IPX SAP Bindery Table** in the Statistics & Logs screen. This table shows detailed information about available IPX services and their location.

Chapter 11

AppleTalk Setup

This chapter discusses the concept of AppleTalk routing and how to configure AppleTalk setup for a Netopia R5000 Series Router with the AppleTalk kit installed.

AppleTalk support is available as a separate kit for the Netopia R5000 Series Router. Skip this chapter if you do not have the AppleTalk kit.

This section covers the following topics:

Note: To take effect, all changes to AppleTalk options require a restart.

AppleTalk networks

A network is a communication system that connects computers so that they share information using network services such as e-mail, print spoolers, and file servers. Information is transferred over a cabling system or WAN using a common set of protocols. You can think of the cabling system as an organization of cities, streets, and buildings and the protocols as the method of sending letters or packages, as illustrated on the following pages. A cable is the physical medium (for example, twisted pair or coaxial) over which information travels from one device to another.

AppleTalk protocol

AppleTalk is a protocol set for local area networks developed by Apple Computer. While initially applied to the LocalTalk cabling system for connecting Macintosh computers and LaserWriter printers, it has been expanded to use other cabling systems such as Ethernet, as well as dial-up telephone networks and packet switching systems. LocalTalk was originally known as the AppleTalk Personal Network system.

Each computer or peripheral device (printer, client, file server) connected to a network is called a node and has a unique node address, which can be any number from 1 to 254. Whenever you open the Chooser or any application that communicates with other computers on your network, your application compiles a list of all node names and addresses. All you see are the names --- for example, "Paul'sMac," "TechSportsWriter," or "2nd Floor AppleShare" --- but your application also knows the node addresses of all these devices.

When you send information, commands, or requests to a printer, server, or another workstation, your application formats the information into units known as packets. It then attaches the correct address to the packets and sends them to the AppleTalk software on your computer, which forwards the packets across the network. Packets also include a return address so the receiver will know where to reply.

If the cabling of your network were a street system, then a node address would correspond to a building's street address. But node addresses are not permanent. Each AppleTalk device determines its node address at startup. Although a Macintosh that is starting up will try to use its previous address, the address will often be different upon restart. This dynamic node addressing scheme prevents conflicts when devices are moved between networks and simplifies the administrative tasks of a network. If you have only one network, the node address alone is all the information AppleTalk needs to send a packet from one computer to another.

However, networks can be connected together through routers, such as the Netopia R5000 Series, into an internetwork (often shortened to internet). Because devices on different networks can have duplicate node numbers, AppleTalk tells them apart according to an additional part of their addresses: the network number.

The Netopia R5000 Series assigns a unique network number to each member network. In terms of the city street metaphor, the network number is similar to the name of the street. Putting a network number together with a node number fully specifies the address of a node on an internet.

To make the services on an internet manageable, groups of devices on a network can be grouped into zones. When this is done, selecting a network service (server, etc.) includes choosing a zone from which the service can be selected. Like network numbers, zone names are assigned by routers.

A routing table is maintained by each AppleTalk router. The table serves as a map of the internet, specifying the path and distance, in hops, between its router and other networks. The routing table is used to determine whether a router will forward a data packet and, if so, to which network.

You can use the information in the AppleTalk routing table to observe and diagnose the Netopia R5000 Series Router's current connections to other AppleTalk routers. To go to the AT Routing Table screen from the Netopia R5000 Series Router's console, select **Statistics & Logs** from the Main Menu and then select **AppleTalk Routing Table**. An AT Routing Table similar to the one shown below appears.

```
                          AT Routing Table

-Net---Range--Def Zone Name----------Hops-State-Next Rtr Addr.--Pkts Fwded
 ---------------------------------SCROLL UP--------------------------
  1     --     Admin                  2    Good  46.131          0
  2     --     AdMan                  2    Good  46.131          0
  3     --     Aspirations            2    Good  46.131          0
  4     --     Sales                  2    Good  46.131          0
  5     --     Marketing              2    Good  46.131          0
  6     --     Molluscs               2    Good  46.131          1
  7     --     Customer Service       2    Good  46.131          1
  8     --     Telemarketing          2    Good  46.131          0
  10    --     Rio                    2    Good  46.131          0
  11    --     Regiment               2    Good  46.131          0
  12    --     Rhinos                 2    Good  46.131          0
  16    --     Unique Services        2    Good  46.131          0
 *24    27     Aspirations            1    Good  46.131          79
  28    31     Rhinos                 1    Good  46.131          15
 ---------------------------------SCROLL DOWN------------------------
UPDATE

'*' Entries have multiple zone names. Return/Enter on these to see zone list.
```

A router has multiple communications ports and is capable of forwarding information to other routers and devices on the internet. The router performs packet forwarding, network and device address maintenance, and other administrative functions required by the AppleTalk protocols.

MacIP

When Macintosh computers encapsulate TCP/IP packets in AppleTalk, because they are either on LocalTalk or EtherTalk, they must use the services of a MacIP gateway. This gateway converts network traffic into the correct format for AppleTalk or IP, depending on the traffic's destination. Setting up MacIP involves enabling the feature and optionally setting up a range of addresses to be static.

See "IP address serving" on page 9-22 for more information on how to set up MacIP and other IP addressing schemes.

AURP

AppleTalk Update-Based Routing Protocol (AURP) allows AppleTalk networks to communicate across an IP network. Your local AppleTalk networks (connected to the Netopia R5000 Series Router) can exchange data with remote AppleTalk networks that are also connected to an AURP-capable router.

When two networks using AppleTalk communicate with each other through a network based on the Internet Protocol, they are said to be "tunneling" through the IP network. The Netopia R5000 Series Router uses AURP to allow your AppleTalk network to tunnel to designated AppleTalk partner networks, as well as to accept connections from remote AppleTalk networks tunneling to your AppleTalk LAN.

Routers and seeding

To configure AppleTalk networks, you must understand the concept of seeding. Seeding is the process by which routers (or more specifically, router ports) agree on which routing information is valid. AppleTalk routers that have been reset, for example, must decide which zones and network numbers are valid before they begin routing. In this case, a router may use the information it has stored or information it receives from another router, depending on how it has been configured.

To help ensure agreement between routers on a network, a seed router is configured with the correct information, and other routers obtain their information from that router when they are turned on or reset.

Routers commonly use one of three types of seeding procedures: hard seeding, soft seeding, and non-seeding.

Hard seeding: When a router that uses hard seeding is turned on or reset, it requests network number and zone name information from any existing routers on the networks it will serve. If no other routers reply, the router uses the network numbers and zone names specified in its own configuration. If other routers reply, and their information matches the router's own configuration information, the result is the same—the router uses the values in its own configuration. However, if other routers provide network numbers or zone names that conflict with those in the router's configuration, the router disables any of its own ports for which there are conflicts.

Soft seeding: When a router that uses soft seeding is turned on or reset, it requests network number and zone name information from any existing routers on the networks it will serve. If no other routers reply, the router uses the network numbers and zone names specified in its own configuration. If other routers reply, the router uses the information they provide, regardless of whether or not there are conflicts between the information received and its configured information. Once a soft- or hard-seeding router begins to route, it can serve as a seed router, providing network number and zone name information to other routers upon request. The default state of the Netopia R5000 Series Router's AppleTalk ports is soft seeding.

Non-seeding: When a router using non-seeding is turned on or reset, it requests network number and zone name information from any existing routers on the networks it will serve. For any network where no other routers reply, the non-seeding router will not have any active ports until the next reset.

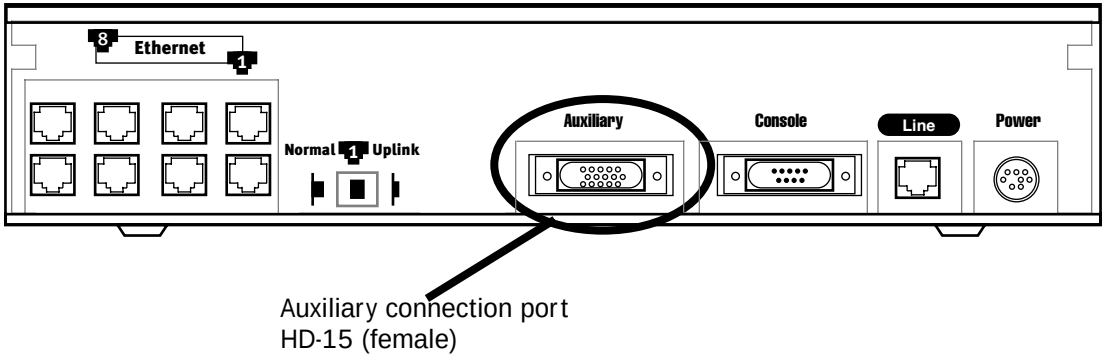
It is important to set the Netopia R5000 Series Router's seeding action to work best in your particular network environment. These scenarios may guide you in deciding how to set the router's seeding:

- If the Netopia R5000 Series Router is the only router on your network, you must set it to either hard seeding or soft seeding. The default is soft seeding.
- If there is another active router on your network and you want that router to configure the Netopia R5000 Series Router's EtherTalk or LocalTalk parameters, you can set the Netopia R5000 Series to non-seeding.
- If there is another active router on your network, you could set the Netopia R5000 Series to be soft seeding if you are unsure whether the second router will always be available to configure the Netopia R5000 Series Router's EtherTalk or LocalTalk parameters.
- If you want the Netopia R5000 Series Router to configure the EtherTalk or LocalTalk parameters of other routers on your network, you must set it to hard seeding. In this case, the other routers must be soft seeding or non-seeding, and the Router must already be active when those other routers are rebooted.
- If you want the Netopia R5000 Series Router and all other routers on your network to use only their own configurations, set the Netopia R5000 Series Router and all other routers to hard seeding. In this case, any router (including the Netopia R5000 Series Router) that is rebooted will not begin routing if it detects a routing conflict between itself and any other router. This last scenario could be useful for detecting and locating routing errors on your network.

Installing AppleTalk

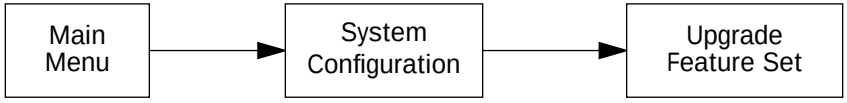
The AppleTalk kit consists of hardware and firmware components that you enable on your router in order to connect an AppleTalk network. The AppleTalk cable supplied in the AppleTalk feature expansion kit cable connects to the Auxiliary port on the Netopia R5000 Series Router.

Netopia R5000 Series Router back panel



You then enable AppleTalk routing through the console-based management screens.

To install the AppleTalk features from the Main Menu, go to System Configuration and select **Upgrade Feature Set**.



The Netopia Feature Set Upgrade screen appears.

```
                    Netopia Feature Set Upgrade

You may be able to extend the features of your Netopia by purchasing a
'Software Upgrade'.  For a list of available upgrades, please see the release
notes that came with your Netopia or visit the Netopia Communications web
site at www.netopia.com.

To purchase an upgrade, you must provide your Serial Number, which is:

        xx-xx-xx

You will receive an Upgrade Key, which you should enter below.

        Upgrade Key:



        UPGRADE NOW                         CANCEL
```

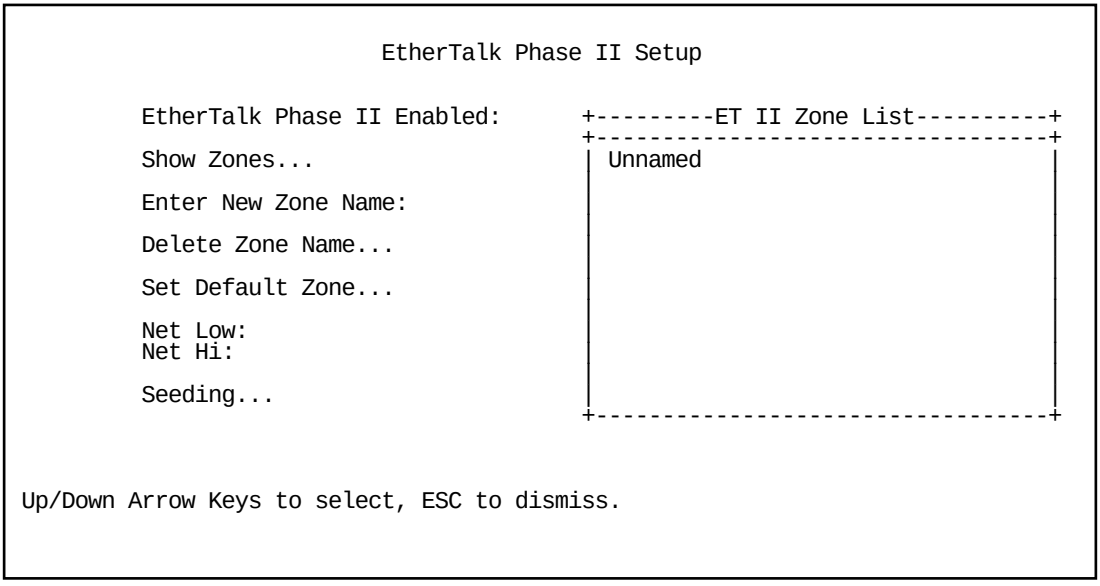
Follow the instructions to enable AppleTalk on your router. Once AppleTalk is enabled, you can configure your network as described in the following sections.

Configuring AppleTalk

AppleTalk setup for Netopia R5000 Series Routers consists of configuring EtherTalk, LocalTalk, and AURP.

EtherTalk setup

In the System Configuration screen, select **Network Protocols Setup** and then select **AppleTalk Setup**. Select **EtherTalk Phase II Setup** and press Return.



- If you are using EtherTalk Phase II on the Ethernet network connected to the Netopia R5000 Series Router, select **EtherTalk Phase II Enabled** and toggle it to **On**.
- To view the zones available to EtherTalk Phase II, select **Show Zones** and press Return. You can dismiss the list of zones by pressing Return or Escape.
- Select **Enter New Zone Name** to enter a new zone name.

  Note: Your EtherTalk network number and zone name must match the values in use on the EtherTalk network.

  If another router is already present on the EtherTalk network that you will be connecting to the Netopia R5000 Series Router, use the zone names and network numbers used by that router for that EtherTalk network. Otherwise, your EtherTalk network may experience routing conflicts. The Netopia R5000 Series Router supports creating up to 32 zone names.

  As an alternative, you can set EtherTalk seeding to soft seeding and let the Netopia R5000 Series Router receive the zone name and network number from the other router.
- To remove zones from the list, select **Delete Zone Name** and press Return to see the zones list. Use the Up and Down Arrow keys to select the zone to delete. Press Return to delete it and exit the list. Press Escape to exit the list without deleting any zones.
- Select **Set Default Zone** to choose a different default zone. This is the zone where the Netopia R5000

Series Router's EtherTalk Phase II port is visible to other AppleTalk nodes. The default zone is also where new AppleTalk nodes will appear. If you do not set a default zone, the first zone you create will be the default zone.

- You can also set the range of EtherTalk Phase II network numbers. Select **Net Low** and enter the lower limit of the network number range. Select **Net High** and enter the upper limit of the range.
- Select the **Seeding** pop-up menu and choose the seeding method for the Netopia R5000 Series Router to use. (See "Routers and seeding" on page 11-3).

You have finished configuring EtherTalk Phase II.

LocalTalk setup

For instructions on making the physical connections for LocalTalk, see "Connecting to a LocalTalk network" on page 4-5.

In the AppleTalk Setup screen, select **LocalTalk Setup** and press Return. The LocalTalk Setup screen appears.

```
                              LocalTalk Setup

        LocalTalk Enabled:                On
        LocalTalk Zone Name:              Unnamed
        LocalTalk Net Number:             33126
        Seeding...                        Soft-Seeding









Use this screen to set up the LocalTalk Port Routing attributes.
```

- If you are using LocalTalk with the Netopia R5000 Series Router, select **LocalTalk Enabled** and make sure LocalTalk is set to **On,** which is the default.

Note: Since the LocalTalk connector attaches to the Auxiliary port on the router, that port will no longer be available for a third external modem.

- Select **LocalTalk Zone Name** and enter a new or existing zone name.

  Note: Your LocalTalk network may already have a zone and network number in place. For the Netopia R5000 Series Router's LocalTalk port to be part of your LocalTalk network, it must have a network number and zone name that matches the values in use on the LocalTalk network.

If another router is already present on the LocalTalk network that you will be connecting to the Netopia R5000 Series Router, use the zone name and network number used by that router for that LocalTalk network. Otherwise, your LocalTalk network may experience routing conflicts.

As an alternative, you can set LocalTalk seeding to soft seeding and let the Netopia R5000 Series Router receive the zone name and network number from the other router.

- Select **LocalTalk Net Number** and enter the desired network number.
- Select **Seeding.** From the pop-up menu, choose the type of seeding for the Netopia R5000 Series Router's LocalTalk port to use (see "Routers and seeding" on page 11-3).

You have finished configuring LocalTalk.

AURP setup

From the Network Protocols screen, select **AppleTalk Setup**. Then select **AURP Setup** and press Return.

The AURP Setup screen appears.

```
                                AURP Setup

        AURP Enable:                          On
        Display/Change Partner...
        Add Partner...
        Delete Partner...

        Enter Free Trade Zone Name:
        Accept Connections From...            Configured Partners Only

        Advanced Options...

AURP Allows you to connect remote AppleTalk Networks across IP.
```

- To activate AURP and enable connections to and from AURP partners, select **AURP Enable** and toggle it to **On**.

Viewing AURP partners

- To see a table of existing AURP partners, select **Display / Change Partner** and press Return.

  Note: The Netopia R5000 Series Router can define a total of 32 AURP partners.

AURP Free Trade Zone

The Free Trade Zone is an AURP security feature. It allows the Netopia administrator to specify a single AppleTalk zone that will be the only one visible to the remote side for partners that have this option enabled.

Example:

Site A has an AURP tunnel to site B. Both sites have multiple zones defined on the EtherTalk port and a unique zone on their LocalTalk ports. If side A has indicated that one of its EtherTalk zones is the Free Trade Zone and has opted to use the Free Trade Zone option for its tunnel to B, then only this Free Trade Zone will show up on side B and only those machines or services in the Free Trade Zone will be accessible to side B. All of side A will be able to see all of side B.

Adding an AURP partner

- To add a new AURP partner, select **Add Partner** and press Return. The Add AURP Partner screen appears.

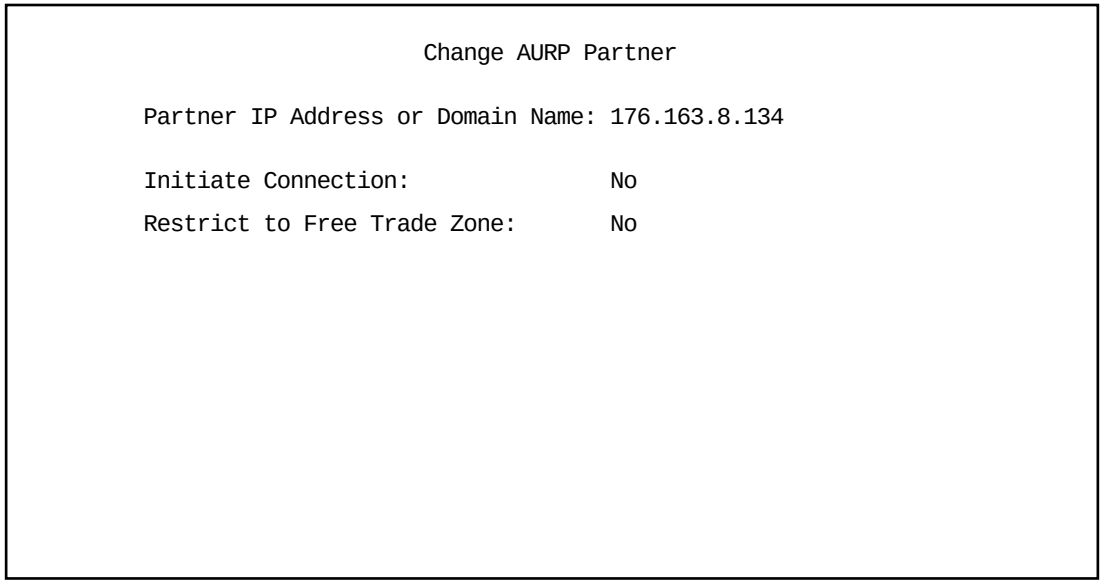
```
                              Add AURP Partner

         Partner IP Address or Domain Name:

         Initiate Connection:               No
         Restrict to Free Trade Zone:       No









         ADD PARTNER NOW                    CANCEL
Enter Information about new Partner.
```

- Select **Partner IP Address or Domain Name** and enter the new AURP partner's IP address. If you do not know the remote network's IP address, enter its domain name. Domain names are the Internet addresses favored by people (for example, chagall.arts.edu). Domain names are matched to the IP addresses actually used by IP routers (for example, 163.7.8.202).
- To initiate a connection with an AURP partner, select **Initiate Connection** and toggle it to **Yes**. This will open a connection to the remote AppleTalk network after rebooting.
- You can choose to restrict this partner to the Free Trade Zone by toggling **Restrict to Free Trade Zone** to **Yes**. See "AURP Free Trade Zone" on page 11-8 for more information.
- To add the new AURP partner, select **ADD PARTNER NOW**. To discard the new AURP partner, select **CANCEL**.

Modifying an AURP partner

- To modify an AURP partner, in the AURP Setup screen select **Display / Change Partner** and press Return. A table of existing partners appears.

  Use the up and down arrow keys to select a partner, then press Return to go to the Change AURP Partner screen. The Change AURP Partner screen appears.



The Change AURP Partner screen has all the values you entered when you added that partner. All of these values may be modified in this screen.

Deleting an AURP partner

- To delete an AURP partner, in the AURP Setup screen select **Delete Partner** and press Return. A table of existing partners appears.

  Use the up and down arrow keys to select an AURP partner, then press Return to delete it. Press Escape to exit without deleting a partner.

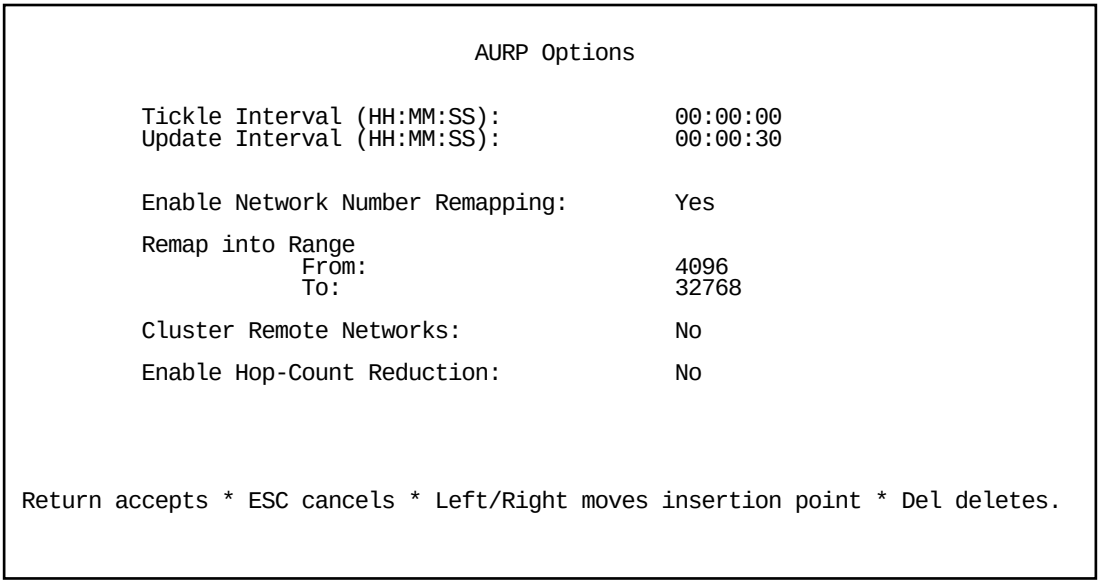
Receiving AURP connections

- To control the acceptance of incoming AURP tunnels, select **Accept Connections From** and choose **Anyone** or **Configured Partners Only** from the pop-up menu. If you choose **Anyone**, all incoming AURP connections will be accepted.

  The more secure option is **Configured Partners Only**, which accepts connections only from recognized AURP partners (the ones you have set up).

Configuring AURP Options

In the AURP Setup screen, select **Advanced Options** and go to the AURP Options screen. Using AURP can cause a problem when two networks, one local and one remote, have the same network number. This may cause network routing ambiguities than can result in routing errors.



- Select **Tickle Interval (HH:MM:SS)** and set the timer to indicate how often a tickle or “Are you still there” packet will be sent to the remote AppleTalk network.

  The AURP tickle timer is a parameter that you can set anywhere between 0 and 100 hours. This parameter tells the AURP partners when to send out an AURP tickle packet. If this value is set to 0, the Netopia R5000 Series Router will never send out a tickle packet. Tickle packets verify that the remote router is working. The minimum tickle interval is 90 seconds. The maximum tickle interval setting is 99:59:59 (100 hours), which is the recommendation for small networks.

  Raising the tickle packet interval does not ensure that the AURP tunnel is dropped or not brought up. If any application on the local network generates AppleTalk traffic destined for the network at the remote end of the AURP tunnel, the tunnel remains up. For example, if a host on the local network connects to a host on the remote network using remote access software, the AURP tunnel remains up. The AURP tunnel also remains up if a local user selects the Chooser and uses an AppleTalk service that involves a remote zone, such as mounting a remote AppleShare volume.

- In many AppleTalk internets, individual AppleTalk networks come and go. Routers are designed to notify each other at the end of their Update Interval every time there's such a change in the network topology. This will cause the Netopia's WAN link to be brought up. To minimize what may be unnecessary calls, change the **Update Interval** value to some larger value. At the end of this time window, if there has been a local AppleTalk network change, the Netopia R5000 Series Router will call any remote AURP partner and forward the new network information.

- To enable network number remapping, select **Enable Network Number Remapping** and toggle it to **Yes**.

  You should enable network number remapping if you plan to use AURP when connecting to unknown AppleTalk networks; for example, when **Accept Connections from Anyone** is enabled. With remapping, the Netopia R5000 Series Router will substitute network numbers not used by your network for the numbers of other remote networks. These safe remappings will only be used by local routers on your network; remote routers will not be aware of the remapping.

When network number remapping is enabled, you *must* choose a safe range of network numbers as a destination for the remapping. A safe range of network numbers does not intersect your local AppleTalk network's range of network numbers.

- To choose a destination range for the remapping, select **From** under **Remap into Range** and enter a starting value. Then select **To** and enter an ending value. Make sure the range you choose is large enough to accommodate all expected incoming AURP network numbers.
- To improve the efficiency of remapping network numbers into a safe range, select **Cluster Remote Networks** and toggle it to **Yes**. This setting takes any number of remote networks being remapped and causes them to be remapped into a continuous range.
- To override the AppleTalk maximum limit of 15 hops, select **Enable Hop-Count Reduction** and toggle it to **Yes**. Hosts on a local AppleTalk network will then detect AppleTalk destinations across the IP tunnel as being only one hop away.

  AppleTalk allows a packet up to 15 hops (going through 15 AppleTalk routers) to reach its destination. Packets that must reach destinations more than 15 hops away will not succeed; therefore, tunneling from one large AppleTalk network to another could exceed that limit. In such a case, hop-count reduction enables full network to network communication.

You have finished configuring AURP.

Chapter 12

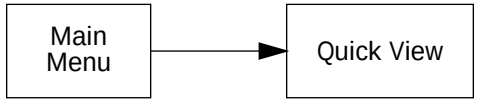
Monitoring Tools

This chapter discusses the Netopia R5000 Series Router's device and network monitoring tools. These tools can provide statistical information, report on current network status, record events, and help in diagnosing and locating problems.

This section covers the following topics:

Quick View status overview

You can get a useful, overall status report from the Netopia R5000 Series Router in the Quick View screen. To go to the Quick View screen, select **Quick View** in the Main Menu.



The Quick View screen has three status sections:

- General status
- Current WAN Connection Status
- LED Status

The status sections vary according to the interface of your Netopia R5000 Series Router.

General status

```
                                Quick View              4/13/1999 12:50:51 PM

Default IP Gateway:  0.0.0.0             CPU Load: 3%    Unused Memory: 529 KB
Domain Name Server:  0.0.0.0
Domain Name: None Provided

----------------MAC Address--------IP Address-------IPX Address---------------
Ethernet Hub:   00-00-c5-70-03-48  192.168.1.1



                          Current Frame Relay Status
--DLCIs In Use--Bytes Rx----Bytes Tx---Frames Rx---Frames Tx---FECNs+BECNs----
          0             0           0           0           0             0



                                  LED Status
PWR-+-----WAN1------+--CON--AUX--+-----WAN2------+--EN--+--------LEDS---------
     LNK RDY CH1 CH2   LNK  LNK   LNK RDY CH1 CH2  DATA | '-'= Off 'G'= Green
```

Current Date: The current date; this can be set with the Date and Time utility (see Date and time on page 8-34).

Default IP Gateway: The router's default gateway, which may be either manually configured or learned via DHCP. This is the value you assigned in the Default IP Gateway field on page 7-8. If you are using the router's defaults (DHCP and NAT) this value will be 0.0.0.0. If you have assigned an IP address as your default gateway, it is shown here.

CPU Load: Percentage of the system's resources being used by all current transmissions.

Unused Memory: The total remaining system memory available for use.

Domain Name Server: If you are using the router's defaults (DHCP and NAT) this value will be 0.0.0.0. If you have assigned an IP address as your default gateway, it is shown here.

Domain Name: the domain name you have assigned, typically the name of your ISP

MAC Address: The Netopia R5000 Series Router's hardware address, for those interfaces that support DHCP.

IP Address: The Netopia R5000 Series Router's IP address, entered in the IP Setup screen.

IPX Address: The Netopia R5000 Series Router's IPX address, entered in the IPX Setup screen.

EtherTalk Address: The Netopia R5000 Series Router's AppleTalk address on its EtherTalk Phase II interface, entered in the EtherTalk Phase II Setup screen (only if the optional AppleTalk feature set is installed).

LocalTalk Address: The Netopia R5000 Series Router's AppleTalk address on its LocalTalk interface, entered in the LocalTalk Setup screen (only if the optional AppleTalk feature set is installed).

Current status

The current status section is a table showing the current status of the WAN. For example, for a Frame Relay configuration:

```
                          Current Frame Relay Status
--DLCIs In Use--Bytes Rx----Bytes Tx---Frames Rx---Frames Tx---FECNs+BECNs----
         0              0           0           0           0              0
```

DLCIs In Use: Shows the number of Frame Relay DLCIs being used, if any.

Bytes Rx: Shows the number of bytes received.

Bytes Tx: Shows the number of bytes transmitted.

Frames Rx: Shows the number of frames received.

Frames Tx: Shows the number of frames transmitted.

FECNs+BECNs: Forward Explicit Congestion Notification (FECN) and Backward Explicit Congestion Notification (BECN) bits in data frames. These are used to determine if traffic becomes sufficiently congested to cause packets to be discarded.

For a profile with PPP data link encapsulation the Current Status section appears slightly different:

```
                          Current WAN Connection Status
    ---Profile Name-------Rate---%Use-Remote Address----Est.-More Info----------
    ISP                   57.6    10  IP 92.163.4.1      Lcl  NAT 192.163.100.6
```

Profile Name: Lists the name of the connection profile being used, if any.

Rate: Shows the data transmission rate.

%Use: Indicates the average percent utilization of the maximum capacity of the channels in use for the connection.

Remote Address: Shows the IP address of the connected remote router if the connection is using IP. Otherwise, shows the IPX address of the connected remote router, if using IPX.

Est: Indicates whether the connection was locally (“Lcl”) or remotely (“Rmt”) established.

More Info: Indicates, in order of priority, the NAT address in use for this connection, the IPX address in use (if IP is also in use), or the ISDN caller identification (if available).

Status lights

This section shows the current real-time status of the Netopia R5000 Series Router’s status lights (LEDs). It is useful for remotely monitoring the router’s status. The Quick View screen’s arrangement of LEDs corresponds to the physical arrangement of LEDs on the router.

```
-PWR-+-----WAN1------+--CON--AUX--+-----WAN2------+--EN--+--------LEDS---------
       LNK RDY CH1 Ch2    LNK  LNK    LNK RDY CH1 CH2  DATA | '-'= Off 'G'= Green
   G    -   G   -   -      Y    -      -   -   -   -    -   | 'R'= Red 'Y'= Yellow
```

Each LED representation can report one of four states:

–: The LED is off.

R: The LED is red.

G: The LED is green.

Y: The LED is yellow.

The section Netopia R5000 Series Router status lights on page 3-5 describes the meanings of the colors for each LED.

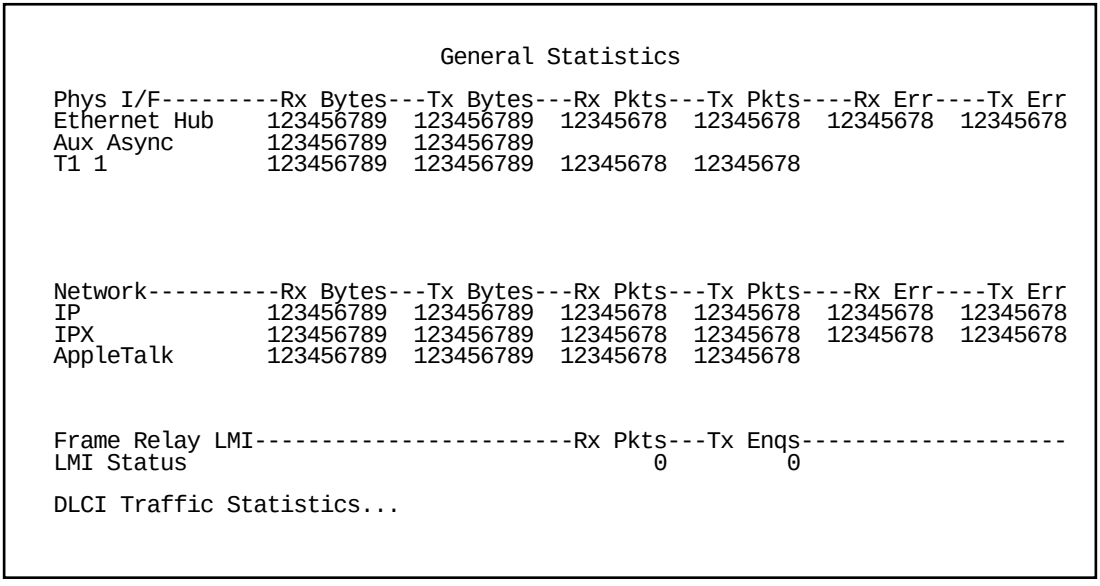
Statistics & Logs

When you are troubleshooting your Netopia R5000 Series Router, the Statistics & Logs screens provide insight into the recent event activities of the router.

From the Main Menu go to Statistics & Logs and select one of the options described in the sections that follow.

General Statistics

To go to the General Statistics screen, select **General Statistics** and press Return. The General Statistics screen appears.



```
                              General Statistics

Phys I/F---------Rx Bytes---Tx Bytes---Rx Pkts---Tx Pkts----Rx Err----Tx Err
Ethernet Hub    123456789  123456789  12345678  12345678  12345678  12345678
Aux Async       123456789  123456789
T1 1            123456789  123456789  12345678  12345678




Network----------Rx Bytes---Tx Bytes---Rx Pkts---Tx Pkts----Rx Err----Tx Err
IP              123456789  123456789  12345678  12345678  12345678  12345678
IPX             123456789  123456789  12345678  12345678  12345678  12345678
AppleTalk       123456789  123456789  12345678  12345678


Frame Relay LMI------------------------Rx Pkts---Tx Enqs--------------------
LMI Status                                 0         0

DLCI Traffic Statistics...
```

The General Statistics screen displays information about data traffic on the Netopia R5000 Series Router's data ports. This information is useful for monitoring and troubleshooting your LAN. Note that the counters roll over at their maximum field width, that is, they restart again at 0.

Physical Interface

The top left side of the screen lists total packets received and total packets transmitted for the following data ports:

- Ethernet Hub
- Aux Async or LocalTalk (if the optional AppleTalk feature set is installed)
- SDSL 1

Network Interface

The bottom left side of the screen lists total packets received and total packets transmitted for the following protocols:

- IP (IP packets on the Ethernet)
- IPX (IPX packets on the Ethernet) if IPX is enabled
- AppleTalk (AppleTalk packets on Ethernet using EtherTalk Phase II if the optional AppleTalk feature set is installed)

- LT (LocalTalk on the PhoneNET) if the optional AppleTalk feature set is installed

The right side of the table lists the total number of occurrences of each of six types of communication statistics:

Rx Bytes: The number of bytes received

Tx Bytes: The number of bytes transmitted

Rx Packets: The number of packets received

Tx Pkts: The number of packets transmitted

Rx Err : The number of bad Ethernet packets received

Tx Err: The number of errors occurring when Ethernet packets are transmitted simultaneously by nodes on the LAN

Event histories

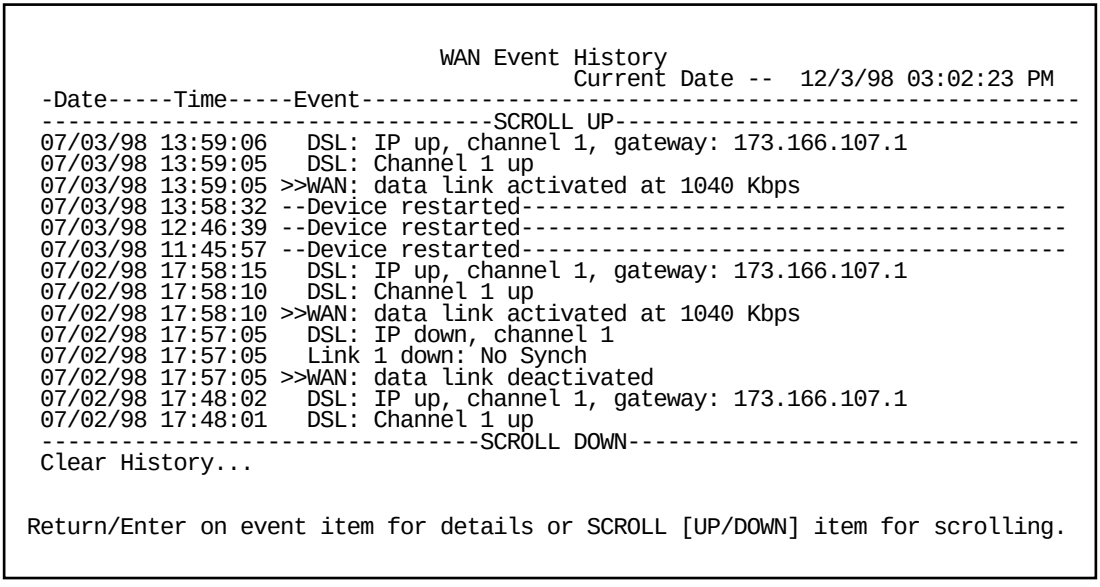
The Netopia R5000 Series Router records certain relevant occurrences in event histories. Event histories are useful for diagnosing problems because they list what happened before, during, and after a problem occurs. You can view two different event histories: one for the router's system and one for the WAN. The Netopia R5000 Series Router's built-in battery backup prevents loss of event history from a shutdown or reset.

The router's event histories are structured to display the most recent events first and to make it easy to distinguish error messages from informational messages. Error messages are prefixed with an asterisk. Both the WAN Event History and Device Event History retain records of the 128 most recent events.

In the Statistics & Logs screen, select **WAN Event History**. The WAN Event History screen appears.

WAN Event History

The WAN Event History screen lists a total of 128 events on the WAN. The most recent events appear at the top.



Each entry in the list contains the following information:

Time: Time of the event.

Date: Date of the event.

Event: A brief description of the event.

Ch.: The channel involved in the event.

Dir. Number: The directory number (number dialed) involved in the event (switched circuit models only).

The first event in each call sequence is marked with double arrows (>>).

Failures are marked with an asterisk (*).

If the event history exceeds the size of the screen, you can scroll through it by using the SCROLL UP and SCROLL DOWN items.

To scroll up, select **SCROLL UP** at the top of the list and press Return. To scroll down, select **SCROLL DOWN** at the bottom of the list and press Return.

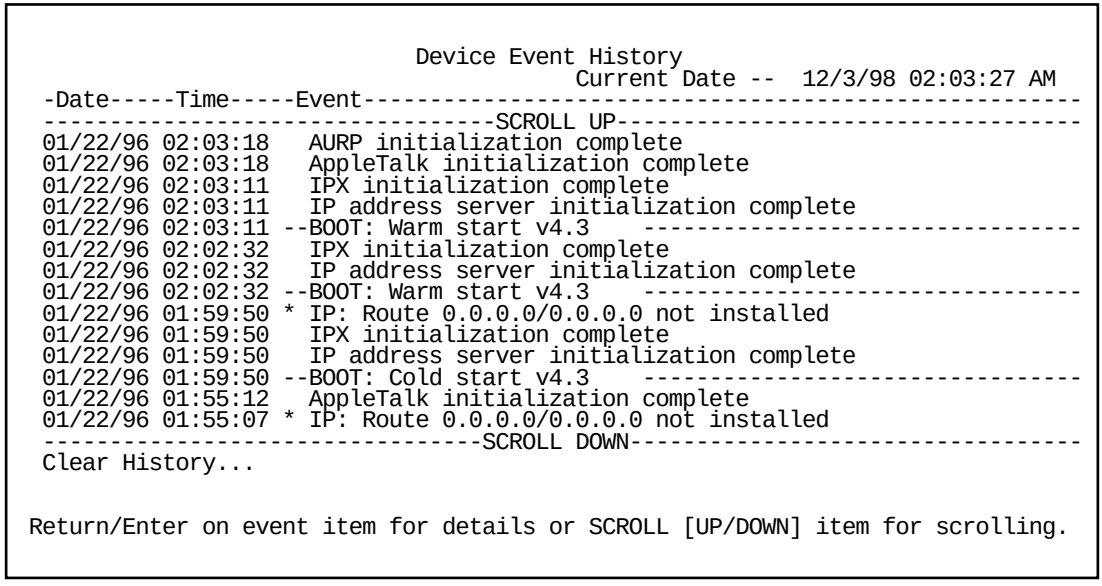
To get more information about any event listed in the WAN Event History, select the event and then press Return. A dialog box containing more information about the selected event will appear. Press Return or Escape to dismiss the dialog box.

To clear the event history, select **Clear History** at the bottom of the history screen and press Return.

Device Event History

The Device Event History screen lists a total of 128 port and system events, giving the time and date for each event, as well as a brief description. The most recent events appear at the top.

In the Statistics & Logs screen, select **Device Event History**. The Device Event History screen appears.



If the event history exceeds the size of the screen, you can scroll through it by using SCROLL UP and SCROLL DOWN.

To scroll up, select **SCROLL UP** at the top of the list and press Return. To scroll down, select **SCROLL DOWN** at the bottom of the list and press Return.

To obtain more information about any event listed in the Device Event History, select the event and then press Return. A dialog box containing more information about the selected event appears. Press Return or Escape to dismiss the dialog box.

To clear the Device Event History, select **Clear History** and press Return.

Routing tables

You can view all of the IP, IPX, and AppleTalk routes in the Netopia R5000 Series Router's IP, IPX, and AppleTalk routing tables, respectively.

To go to a routing table screen, select the routing table you are interested in from the Statistics & Logs screen.

Each of the routing table screens represents a snapshot of the routing table information at the time the screen is first invoked. To take a new snapshot, select **Update** at the bottom of the screen and press Return.

```
                          Statistics & Logs


                    WAN Event History...
                    Device Event History...

                    IP Routing Table...

                    IPX Routing Table...
                    IPX SAP Bindery Table...

                    AppleTalk Routing Table...

                    Served IP Addresses...

                    General Statistics...

                    System Information...
```

IP routing table

In the Statistics & Logs screen, select **IP Routing Table** and press Return.

The IP routing table displays all of the IP routes currently known to the Netopia R5000 Series Router.

```
                              IP Routing Table

Network Address-Subnet Mask-----via Router------Port------------------Type----
-----------------------------------SCROLL UP-------------------------------------
0.0.0.0         255.0.0.0       0.0.0.0         --                    Other
127.0.0.1       255.255.255.255 127.0.0.1       Loopback              Local
192.168.1.0     255.255.255.240 192.168.1.1     Ethernet              Local
192.168.1.1     255.255.255.255 192.168.1.1     Ethernet              Local
192.168.1.15    255.255.255.255 192.168.1.15    Ethernet              Bcast
224.0.0.0       224.0.0.0       0.0.0.0         --                    Other
255.255.255.255 255.255.255.255 255.255.255.255 --                    Bcast









---------------------------------SCROLL DOWN-------------------------------------
UPDATE
```

IPX routing table

In the Statistics & Logs screen, select **IPX Routing Table** and press Return.

The IPX routing table displays all of the IPX routes currently known to the Netopia R5000 Series Router.

IPX Sap Bindery table

In the Statistics & Logs screen, select **IPX Sap Bindery Table** and press Return.

The IPX Sap Bindery table displays all of the IPX Sap Bindery routes currently known to the Netopia R5000 Series Router.

AppleTalk routing table

In the Statistics & Logs screen, select **AppleTalk Routing Table** and press Return. An AT Routing Table similar to the one shown below will appear.

The AppleTalk routing table displays information about the current state of AppleTalk networks connected to the Netopia R5000 Series Router, including remote AppleTalk networks connected with AURP. This information is gathered from other active AppleTalk routers.

```
                              AT Routing Table

-Net---Range--Def Zone Name----------Hops-State-Next Rtr Addr.--Pkts Fwded
 ----------------------------------SCROLL UP-------------------------
  1     --     Admin                   2    Good  46.131          0
  2     --     AdMan                   2    Good  46.131          0
  3     --     Aspirations             2    Good  46.131          0
  4     --     Sales                   2    Good  46.131          0
  5     --     Marketing               2    Good  46.131          0
  6     --     Molluscs                2    Good  46.131          1
  7     --     Customer Service        2    Good  46.131          1
  8     --     Telemarketing           2    Good  46.131          0
  10    --     Rio                     2    Good  46.131          0
  11    --     Regiment                2    Good  46.131          0
  12    --     Rhinos                  2    Good  46.131          0
  16    --     Unique Services         2    Good  46.131          0
 *24    27     Aspirations             1    Good  46.131          79
  28    31     Rhinos                  1    Good  46.131          15
 ----------------------------------SCROLL DOWN-----------------------
UPDATE

'*' Entries have multiple zone names. Return/Enter on these to see zone list.
```

The table has the following columns:

Net: Displays the starting network number supplied by the AppleTalk router in the **Next Rtr Addr.** column. If a network number is preceded by an asterisk (*), it has multiple zones. To display the zones, select the network entry and press Return.

Range: Displays the ending network number for the extended network.

Def Zone Name: Displays the zone or zones associated with the specified network or network range. The zone name shown is either the only zone or the default zone name for an extended network. To see the complete list of zones for an extended network with multiple zones, select the entry in the table and press Return. Press Return again to close the list of zones.

Hops: Displays the number of routers between the Netopia R5000 Series Router and the specified network.

State: Displays the state of the specified route, based on the frequency of Routing Table Maintenance Protocol (RTMP) packets received for the route. The state can be Good, Suspect, or Bad. AppleTalk routers regularly exchange RTMP packets to update AppleTalk routing information.

Next Rtr Addr.: Displays the DDP or IP address of the next hop for the specified route. A DDP address is displayed if the router shown is on the local AppleTalk network. DDP address means that a connection to the next-hop router is by a native AppleTalk network (e.g., LocalTalk or EtherTalk Phase II). An IP address is displayed if the Netopia R5000 Series Router is connected to the router shown using AURP. IP address means a connection transports over AURP (AppleTalk encapsulated IP).

Pkts Fwded: The number of packets sent to the router shown.

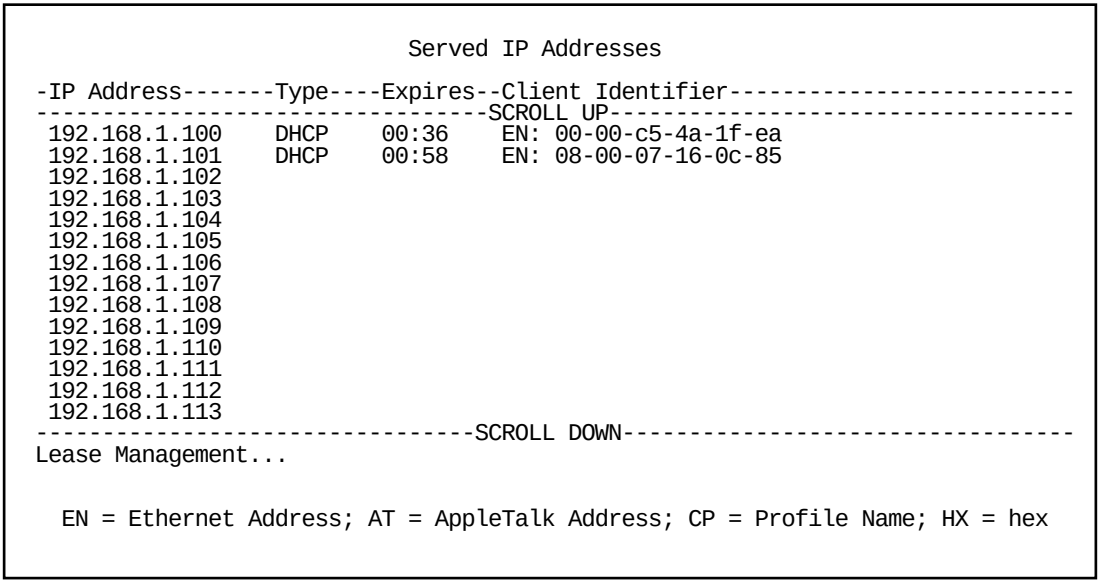
Each row in the AppleTalk routing table corresponds to an AppleTalk route or network range. If the list of routes shown exceeds the size of the screen, you can scroll through it by using SCROLL UP and SCROLL DOWN.

To scroll up, select **SCROLL UP** at the top of the table and press Return. To scroll down, select **SCROLL DOWN** at the bottom of the table and press Return.

Served IP Addresses

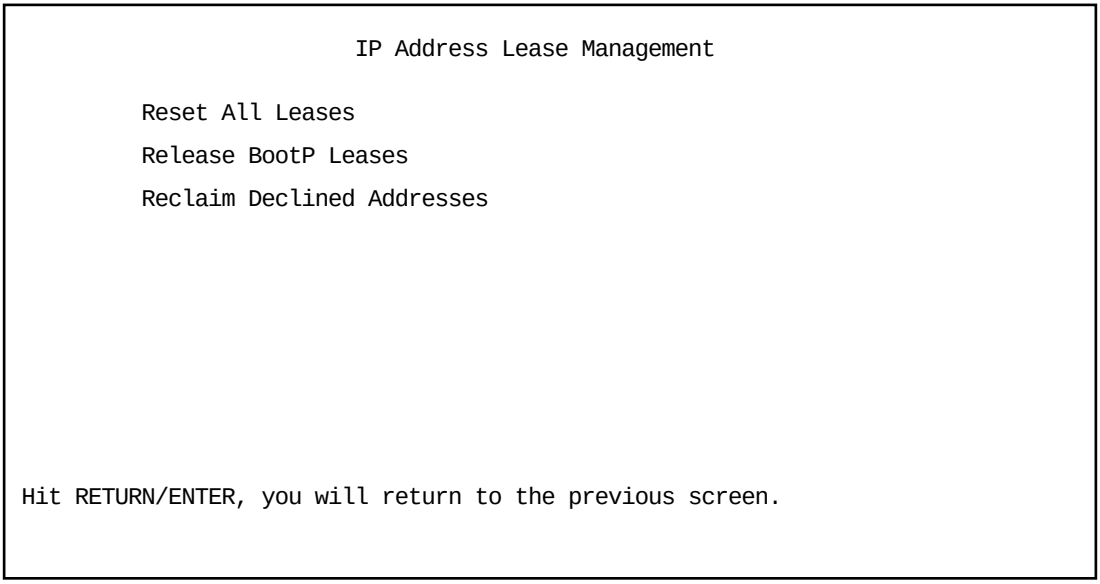
You can view all of the IP addresses currently being served by the Netopia R5000 Series Router from the **Served IP Addresses** screen.

From the Statistics & Logs menu, select **Served IP Addresses**. The Served IP Addresses screen appears.



To manage DHCP leases, select **Lease Management** in this screen.

The IP Address Lease Management screen appears.



This screen has three options:

- **Reset All Leases**: Resets all current IP addresses leased through DHCP without waiting for the default one–hour lease period to elapse
- **Release BootP Leases**: Releases any BootP leases that may be in place and which may no longer be required.
- **Reclaim Declined Addresses**: Reclaims served leases that have been declined; for example by devices that may no longer be on the network.

System Information

The System Information screen gives a summary view of the general system level values in the Netopia R5000 Series Router.

From the Statistics & Logs menu select **System Information**. The System Information screen appears.

```
                        System Information


Serial Number                       70-03-48 (7340872)
Firmware Version                    4.3.3

Processor Speed (MHz)               33
Flash ROM Capacity (MBytes)         1
DRAM Capacity (MBytes)              4

Ethernet                            8 Port 10Base-T
Auxiliary Serial Port               Switched Async
WAN 1 Interface                     T1
WAN 2 Interface                     Not Installed

AppleTalk Feature Set               Not Installed

Analog Dial-In Kit                  Installed
```

The information display varies by model, firmware version, feature set, and so on. You can tell at a glance your particular system configuration.

SNMP

The Netopia R5000 Series Router includes a Simple Network Management Protocol (SNMP) agent, allowing monitoring and configuration by a standard SNMP manager.

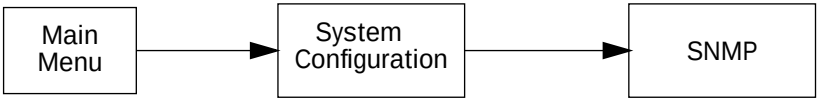
The Netopia R5000 Series Router supports the following management information base (MIB) documents:

- MIB II (RFC 1213)
- Interface MIB (RFC 1229)
- Ethernet MIB (RFC 1643)
- AppleTalk MIB I (RFC 1243)
- Netopia MIB

These MIBs are on the Netopia R5000 Series Router CD included with the Netopia R5000 Series Router. Load these MIBs into your SNMP management software in the order they are listed here. Follow the instructions included with your SNMP manager on how to load MIBs.

The SNMP Setup screen

From the Main Menu, select **SNMP** in the System Configuration screen and press Return. The SNMP Setup screen appears.




```
                                SNMP Setup

          System Name:
          System Location:
          System Contact:


          Read-Only Community String:                  public
          Read/Write Community String:                 private

          Authentication Traps Enable:                 Off

          IP Trap Receivers...




 Configure optional SNMP parameters from here.
```

Follow these steps to configure the first three items in the screen:

1. Select **System Name** and enter a descriptive name for the Netopia R5000 Series Router's SNMP agent.
2. Select **System Location** and enter the router's physical location (room, floor, building, etc.).
3. Select **System Contact** and enter the name of the person responsible for maintaining the router.

System Name, System Location, and System Contact set the values returned by the Netopia R5000 Series Router SNMP agent for the SysName, SysLocation, and SysContact objects, respectively, in the MIB II system group. Although optional, the information you enter in these items can help a system administrator manage the network more efficiently.

Community strings

The **Read-Only Community String** and the **Read / Write Community String** are like passwords that must be used by an SNMP manager querying or configuring the Netopia R5000 Series Router. An SNMP manager using the **Read-Only Community String** can examine statistics and configuration information from the router, but cannot modify the router's configuration. An SNMP manager using the **Read / Write Community String** can both examine and modify configuration parameters.

By default, the read-only and read/write community strings are set to **public** and **private**, respectively. You should change both of the default community strings to values known only to you and trusted system administrators.

To change a community string, select it and enter a new value.

Starting with the version 4.3 firmware, setting the Read-Only and Read-Write community strings to the empty string will block all SNMP requests to the router. (The router may still send SNMP Traps if those are properly enabled.)

Previously, if either community string was the empty string, SNMP Requests specifying an empty community string were accepted and processed.

This change is designed to allow the administrator to block SNMP access to the router and to provide more granular control over the allowed SNMP operations to the router.

- Setting only the Read-Write community string to the empty string will block SNMP Set Requests to the router, but Get Requests and Get-Next Requests will still be honored using the Read-Only community string (assuming that is not the empty string).
- Setting only the Read-Only community string to the empty string will *not* block Get Requests or Get-Next Requests since those operations (and Set Requests) are still allowed using the (non-empty) Read-Write community string.

Even if you decide not to use SNMP, you should change the community strings. This prevents unauthorized access to the Netopia R5000 Series Router through SNMP. For more information on security issues, see Suggested security measures on page 13-1.

SNMP traps

An SNMP trap is an informational message sent from an SNMP agent (in this case, the Netopia R5000 Series Router) to a manager. When a manager receives a trap, it may log the trap as well as generate an alert message of its own.

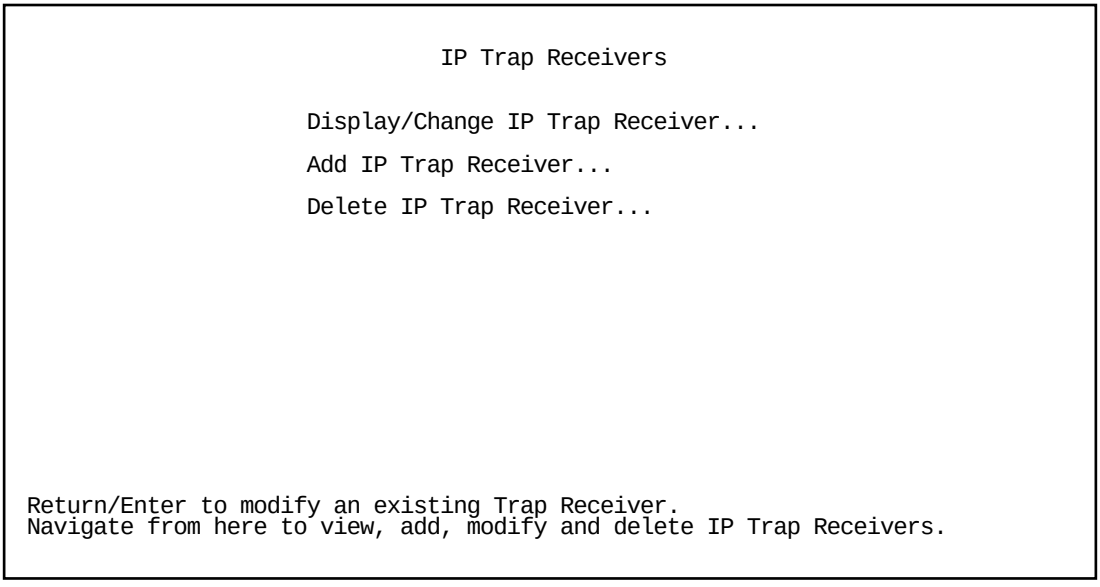
Standard traps generated by the Netopia R5000 Series Router include the following:

- An authentication failure trap is generated when the router detects an incorrect community string in a received SNMP packet. **Authentication Traps Enable** must be **On** for this trap to be generated.
- A cold start trap is generated after the router is reset.
- An interface down trap (ifDown) is generated when one of the router's interfaces, such as a port, stops functioning or is disabled.
- An interface up trap (ifUp) is generated when one of the router's interfaces, such as a port, begins functioning.

The Netopia R5000 Series Router sends traps using UDP (for IP networks).

You can specify which SNMP managers are sent the IP traps generated by the Netopia R5000 Series Router. Up to eight receivers can be set. You can also review and remove IP traps.

To go to the IP Trap Receivers screen, select **IP Trap Receivers**. The IP Trap Receivers screen appears.



Setting the IP trap receivers

1. Select **Add IP Trap Receiver**.
2. Select **Receiver IP Address or Domain Name**. Enter the IP address or domain name of the SNMP manager you want to receive the trap.
3. Select **Community String** if you enabled one in the SNMP Setup screen, and enter the appropriate password.
4. Select **Add Trap Receiver Now** and press Return. You can add up to seven more receivers.

Viewing IP trap receivers

To display a view-only table of IP trap receivers, select **Display / Change IP Trap Receiver** in the IP Trap Receivers screen.

Modifying IP trap receivers

1. To edit an IP trap receiver, select **Display / Change IP Trap Receiver** in the IP Trap Receivers screen.
2. Select an IP trap receiver from the table and press Return.
3. In the **Change IP Trap Receiver** screen, edit the information as needed and press Return.

Deleting IP trap receivers

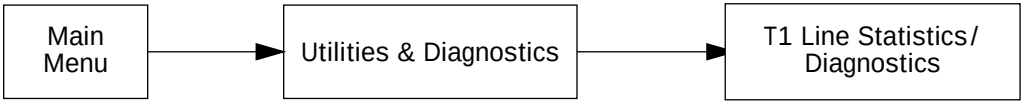
1. To delete an IP trap receiver, select **Delete IP Trap Receiver** in the IP Trap Receivers screen.
2. Select an IP trap receiver from the table and press Return.
3. In the dialog box, select **Continue** and press Return. (Select **Cancel** and press Return if you change your mind and don't want to delete it.)

T1 Diagnostics

The Utilities and Diagnostics menu includes an option for displaying T1 line statistics.

T1 Line Statistics and Diagnostics screen

You access the Utilities and Diagnostics menu from the Main Menu.




```
                        Utilities & Diagnostics


                    Ping...
                    Trace Route...
                    Telnet...




                    Trivial File Transfer Protocol (TFTP)...
                    X-Modem File Transfer...

                    Revert to Factory Defaults...

                    Restart System...

                    T1 Line Statistics / Diagnostics...

Send ICMP Echo Requests to a network host.
```

Select **T1 Line Statistics / Diagnostics** and press Return.

The T1 Line Statistics / Diagnostics screen appears.

```
                          T1 Line Statistics / Diagnostics

 --Condition-----------------00:00---09:58---09:43---09:28---09:13---24 hours-
 Errored Seconds                000      000      000      000      000       00000
 Unavailable Seconds            000      000      000      000      000       00000
 Severely Errored Seconds       000      000      000      000      000       00000
 Bursty Errored Seconds         000      000      000      000      000       00000
 Loss of Frame Count            000      000      000      000      000       00000
 Bipolar Violation Count        000      000      000      000      000       00000


        Line Status:                      Normal Operation
        Loopback Status:                  Clear - No Loopback Enabled


        Tests...                          Normal
```

The screen displays the current condition of tests that you run. The counters display the occurrences of the indicated events in fifteen-minute increments, shifting the totals to the column to the right after each fifteen minute cycle until the total is accumulated in the 24 hour column.

Condition: Displays the parameters tested.

Time columns: Current time (00:00) starts at zero and resets to zero at 15:00 minutes, shifting the counted total to the next column to its right.

24 hours: Cumulative statistics, for the preceding 24 hour period.

Line Status: Conditions may be: Normal Operation, Red Alarm, Yellow Alarm, or (Rmt/Lcl) LoopBack

Loopback Status: Current loopback condition

Tests offers a pop-up menu with the following options:

- **Normal - Clear Loopback** clears any local loopbacks, and sends an ANSI PLB clear to the remote CSU. This returns the Netopia R5000 Series Router to its normal state if any testing has been done and the router has been put into a looped state. Select this option after running tests to return the router to a normal state so that it is capable of passing traffic as it should.
- **Send Blue Alarm -all 1s** forces an error condition of all 1s, remote will send a yellow alarm if enabled. You can use this pattern in two different ways. Once a remote router has been looped you can use it to verify that you are receiving the same data that you are sending. For example, if you send all ones across the line and get back a mixture of ones and zeroes, there is a problem. You can also use this test in a different way. If you send all ones to a remote device, it should report that it is receiving all ones. This would verify (without having to put up a loop) that data is reaching the destination intact. It does not verify bi-directional integrity however, which is verified if you have the remote end in loop. This pattern is also for checking the remote end's capability of reporting back a yellow alarm (usually something that is optionally enabled on

the remote CSU).

- **Remote Payload Loopback** sends an ANSI BPM payload loopback request to the remote CSU. This pattern tells the remote device (usually the CSU at the other end of the circuit) that it should go into a looped state. Use this pattern for putting up a loop to do testing from a remote portion of the circuit, either by the Telco or by the CPE equipment at the remote end of the circuit. This test makes the remote CSU go into a looped state so that any data you send it is returned to you. This is useful for determining if the remote CSU is receiving data from the local equipment. If it does not loop then you can conclude that it is not receiving any data from you.
- **Local Payload Loopback** enables a local payload loopback. This pattern is similar to the Remote Payload Loopback pattern except that it puts the local CSU into a looped state rather than the remote CSU. This is useful if the remote side is not able to send a remote loop code to the router to put it into a looped state. You can simply put it into loopback manually and see if that loop is reflected at the remote side.
- **Loopback Pattern Test** sends continuous 1200 byte packets and compares incoming packets (similar to ISDN loopback tests). Counts good and bad packets. Twenty consecutive good packets are required to PASS. The loopback testing screen is only visible when this test is selected. It sends a pseudo-random sequence that is intended to simulate data so that you can check for errors on the circuit. This test requires that the remote CSU be in a payload loopback condition. (It will partially work if the remote CSU is in a LINE loopback condition as well, but this is less reliable.)

When you select one of these tests and press Return, the test runs and the screen provides feedback.

Web-based monitoring

This section discusses the Netopia R5000 Series Router's device and network web-based monitoring tool. This tool can provide statistical information, report on current network status, record events, and help in diagnosing and locating problems. You can view connection profile information and event histories in the web-based monitoring pages, as well as configure and track budgets for switched connections.

You access the web-based monitoring pages by launching your web browser and entering the URL:

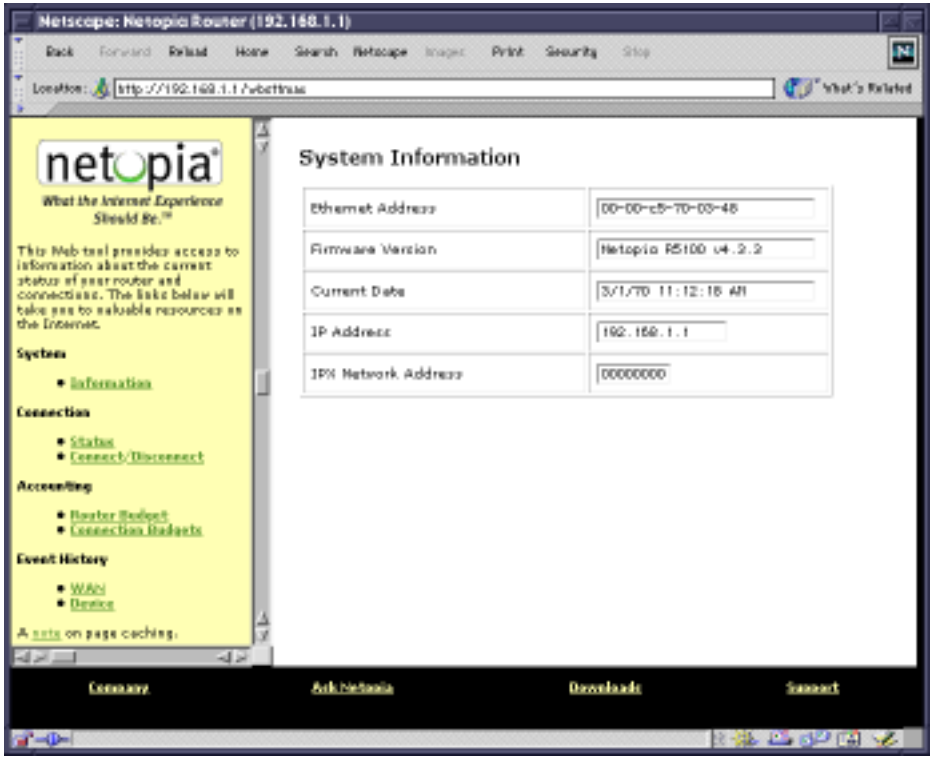
http://*router_IP_address*

where *router_IP_address* is the address of your router. The default address is 198.162.1.1.

The System Information page appears.

System Information page

This is the initial page you link to when you connect to the web-based management pages.



It displays useful general information about your router:

Ethernet Address: The router's hardware or MAC address

Firmware Version: The router's model number and current firmware revision level

Current Date: The current date and time, as you have configured them

IP Address: The router's internal IP address

IPX Network Address: The router's IPX network address, if you have it enabled and are on an IPX network

The display contains two frames, a navigation frame on the left and the information and configuration page on the right.

The left frame permits you to navigate to:

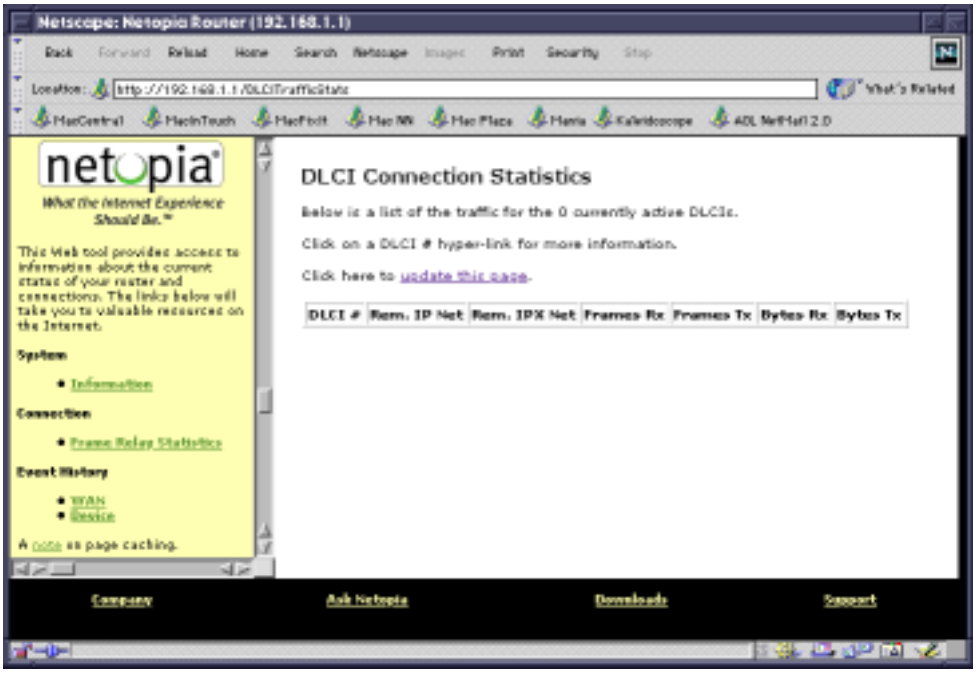
- System
  - Information: displays the router's hardware (MAC) address, the model number and firmware version currently installed, the current date and time. the router's IP address and the IPX address, if any.
- Connection
  - Frame Relay Statistics page on page 12-22 *(for frame relay configured devices only)*: displays a snapshot of the activity for your Frame relay DLCIs.
  - Connection Status page on page 12-23 *(for switched interfaces only)*: displays the current state of your switched connection.
  - Connect/Disconnect page on page 12-24 *(for switched interfaces only)*: displays a list of your connection profiles, allowing you to initiate connections using any one of them.
- Accounting *(for switched interfaces only)*

  If you have a leased line with an unswitched interface, these options do not appear.
  - Router Budget Configuration page on page 12-25: allows you to display and edit your aggregate connection accounting statistics and limits.
  - Connection Budgets page on page 12-26: allows you to set up and track three connection budgets for cost control purposes.
- Event History
  - WAN Event History page on page 12-29: displays the most recent events that the router reports for your WAN connections.
  - Device Event History page on page 12-30: displays the most recent events that the router reports of its own internal activity.

If you click any link in the left frame, that page is displayed in the right frame.

Frame Relay Statistics page

For leased line connections, the Frame Relay Statistics page displays a snapshot of the activity for your Frame relay DLCIs.



The table gives the following information:

DLCIs In Use: The number of Frame Relay DLCIs being used, if any.

DLCI #: The DLCI number as you have configured it.

Rem. IP Net. The remote IP network address.

Rem. IPX Net. The remote IPX network address, if any.

Frames Tx: Shows the number of frames transmitted.

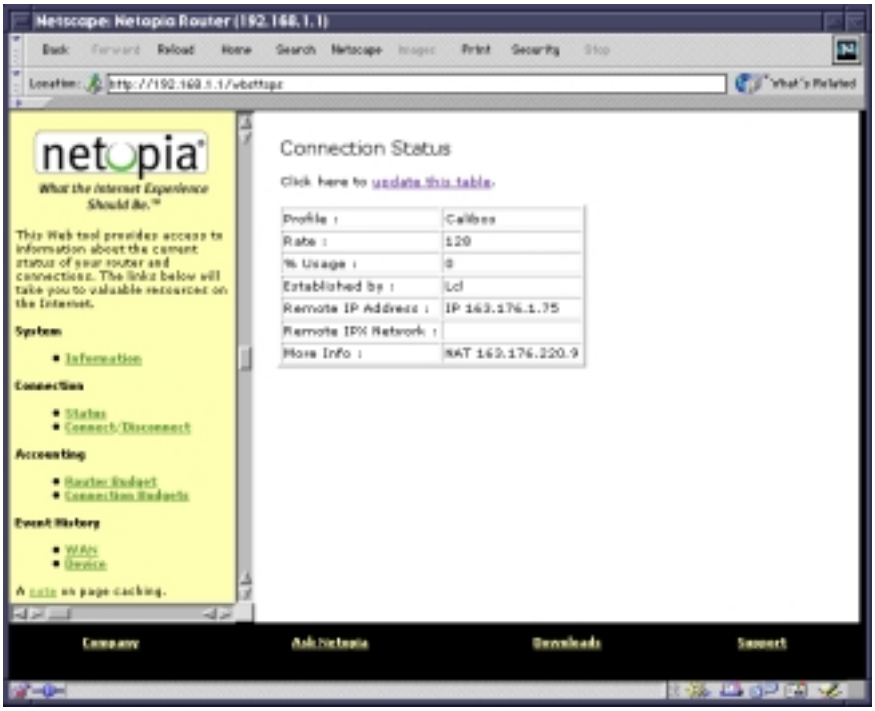
Bytes Rx: The number of bytes received.

Bytes Tx: The number of bytes transmitted.

To update the information displayed, click the **update this page** link.

Connection Status page

For switched interface connections, the Connection Status page displays information for your active connection profile and, if applicable, any POTS calls currently active.



The table gives the following information:

Profile name: The name you have assigned to the connection profile that is currently connected.

Rate: The data rate of this connection.

% Usage: The average percent utilization of the maximum capacity of the channels in use for the connection.

Established by: Whether the connection was locally (“Lcl”) or remotely (“Rmt”) established.

Remote IP Address: The address of the connection on the remote end.

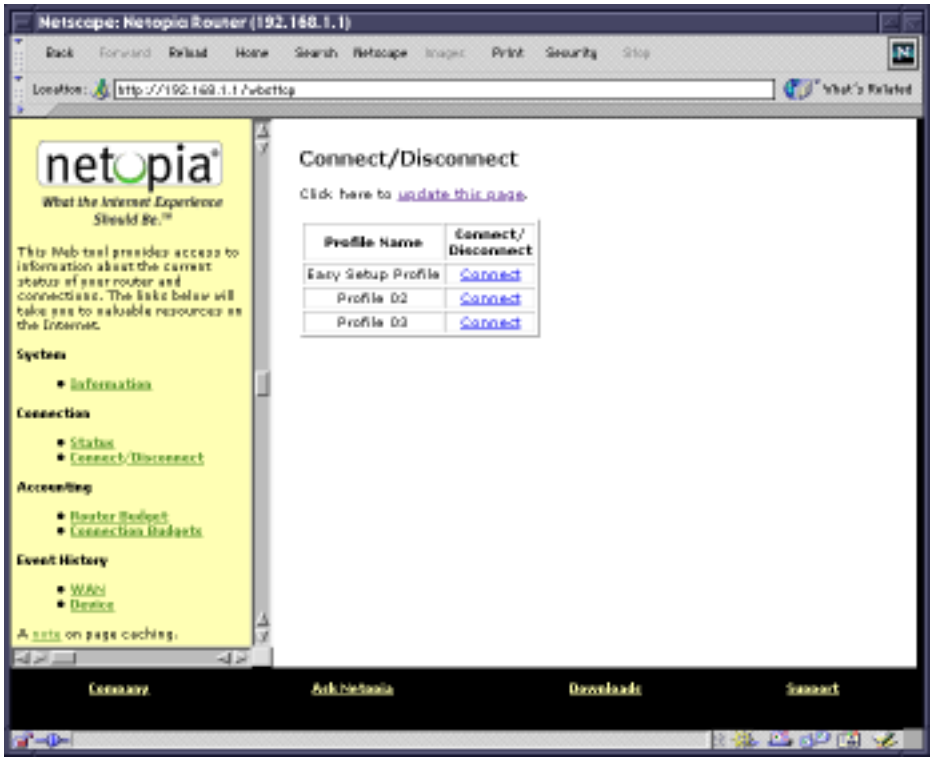
Remote IPX Network: If you are routing IPX traffic, the address of the remote IPX source.

More Info: In order of priority, the NAT address in use for this connection, the IPX address in use (if IP is also in use), or the ISDN caller identification (if available).

To update the information displayed, click the **update this page** link.

Connect/Disconnect page

The Connect/Disconnect page displays a list of your configured connection profiles and allows you to connect or disconnect any of them.

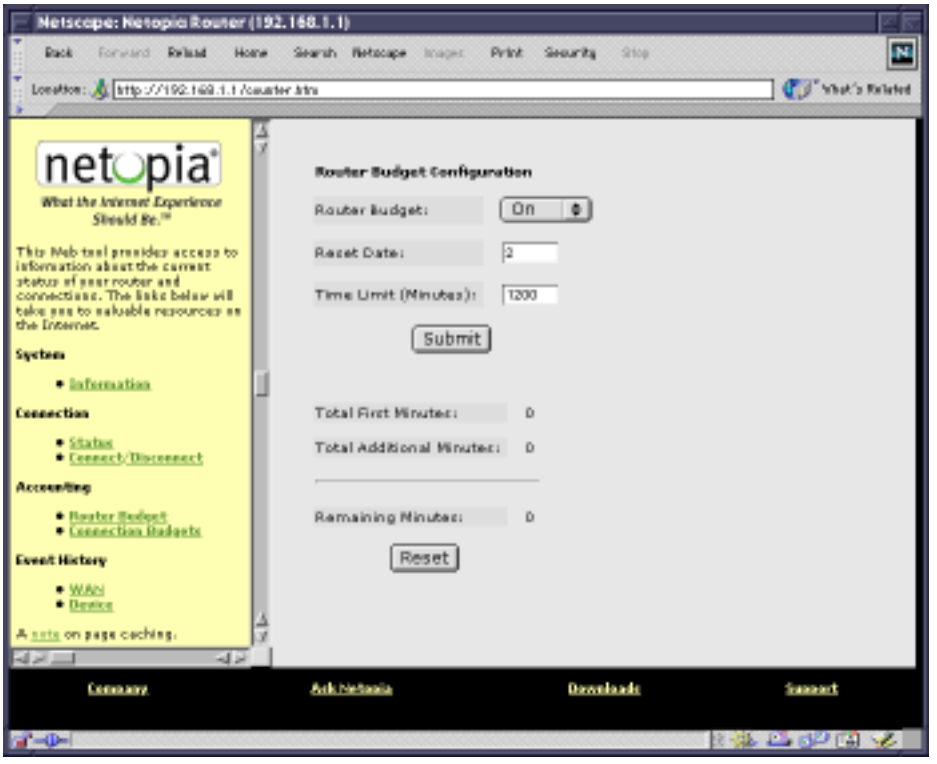


To initiate a connection using any of the displayed connection profiles, simply click the **Connect** link.

To disconnect from an active connection profile, click the **Disconnect** link.

Router Budget Configuration page

The Router Budget Configuration page allows you to modify the parameters for your overall connection accounting policy.



From this page you can:

- turn Router Budget either **On** or **Off** from the pull-down menu
- change the Reset Date (day) on which the counters begin counting again
- change the total aggregate Time Limit in minutes covered by all of your budgets.

If you make any changes in this screen, click the **Submit** button.

To reset the aggregate minute counters to zero again, click the **Reset** button.

The table displays the following information:

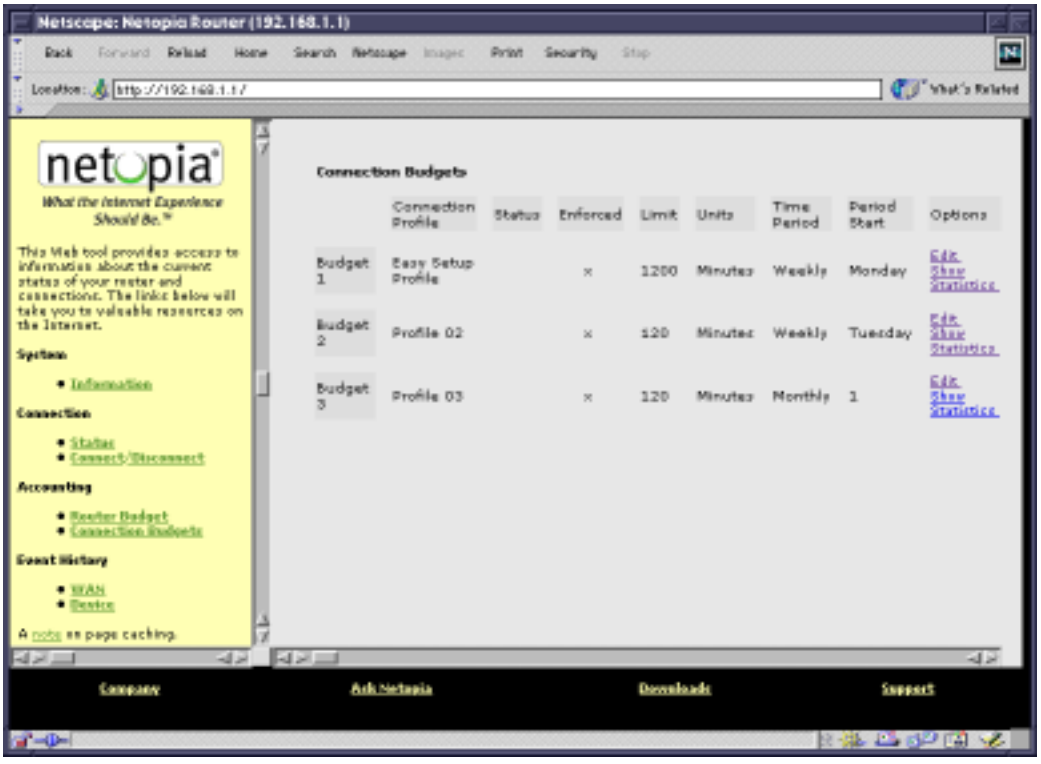
First Minutes. The number of first minutes of outbound calls to be placed during the recording interval for all your configured budgets

Total Additional Minutes. The total time of all outbound calls to be placed during the recording interval for all your configured budgets

Remaining Minutes. The time remaining during the recording interval for all your configured budgets

Connection Budgets page

The Connection Budgets page displays information for three budgets or connection profiles for tracking and controlling connection usage on a per-connection profile basis.

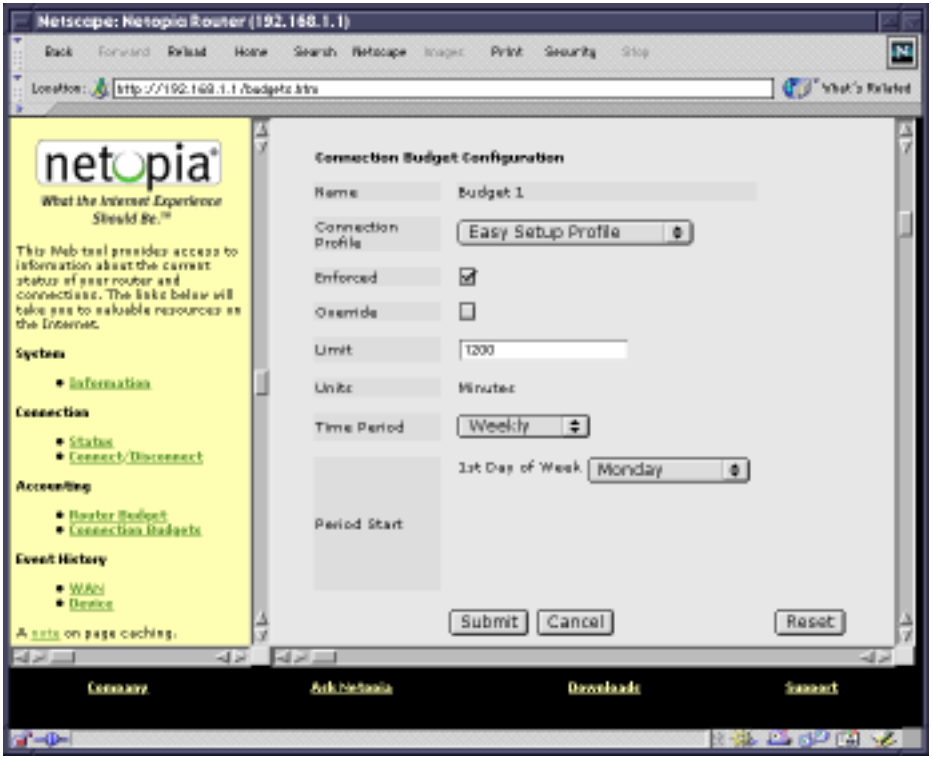


You configure your budgets in the Budget Configuration page.

To configure a Budget. click the **Edit** link for that Budget. The Connection Budget Configuration page on page 12-27 appears.

To view the statistics for each budget, click the **Show Statistics** link. The Budget Statistics page on page 12-28 appears.

Connection Budget Configuration page



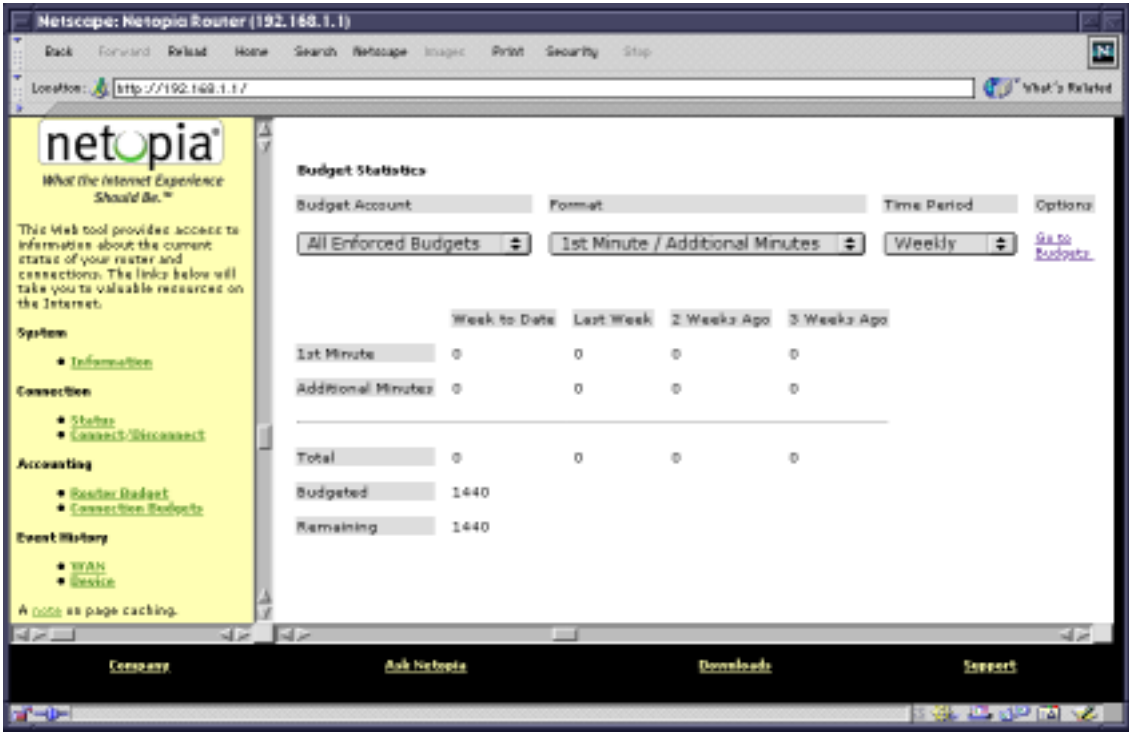
You can configure budgets to be:

- **Enforced**, meaning that when you reach the usage limit for the assigned time period, the connection profile will allow no more connections. If the budget is not enforced, the system will merely keep track of its usage. To enforce this budget, check the **Enforced** checkbox.
- in **Override** mode. Checking this option allows you to exceed your budget during the current time period without tearing down active connections. At the end of the current time period this option is automatically deactivated. If you want to be able to exceed your enforced budget again, you must check this option for each new time period.

  Checking **Override** disables call blocking, even if the call is over its limit. The override flag is automatically reset to be off at the start of a new period. This is so that you don't need to set Enforced to off to by-pass the limit, and then forget to turn it back on when the new period starts.
- set to a predefined **Limit** of minutes of usage
- set to the **Time Period**, weekly or monthly, that you specify for your own budgeting requirements
- started on a specific day of the week or month by selecting the day you want to start from the pull-down menu. If you set a weekly schedule, you choose the day of the week to start it; if you set a monthly schedule, you choose the day of the month to start it.

Click the **Submit** button to enable your entries and be returned to the Connection Budgets page or click the **Cancel** button to discard all your entries. Click the **Reset** button to reset all counters and archives to zero.

Budget Statistics page



You can view statistics for all of your budgets at once or one at a time.

- To view the statistics for a single budget or all enforced budgets, select the budget you want to view from the **Budget Account** pull-down menu.
- Select the **Format** you want to view, either 1st Minute/Additional Minutes or Channel 1/Channel 2.
- Select the **Time Period** you want to view, either weekly or monthly.

The information display will immediately change to show the information you specified in the format you chose.

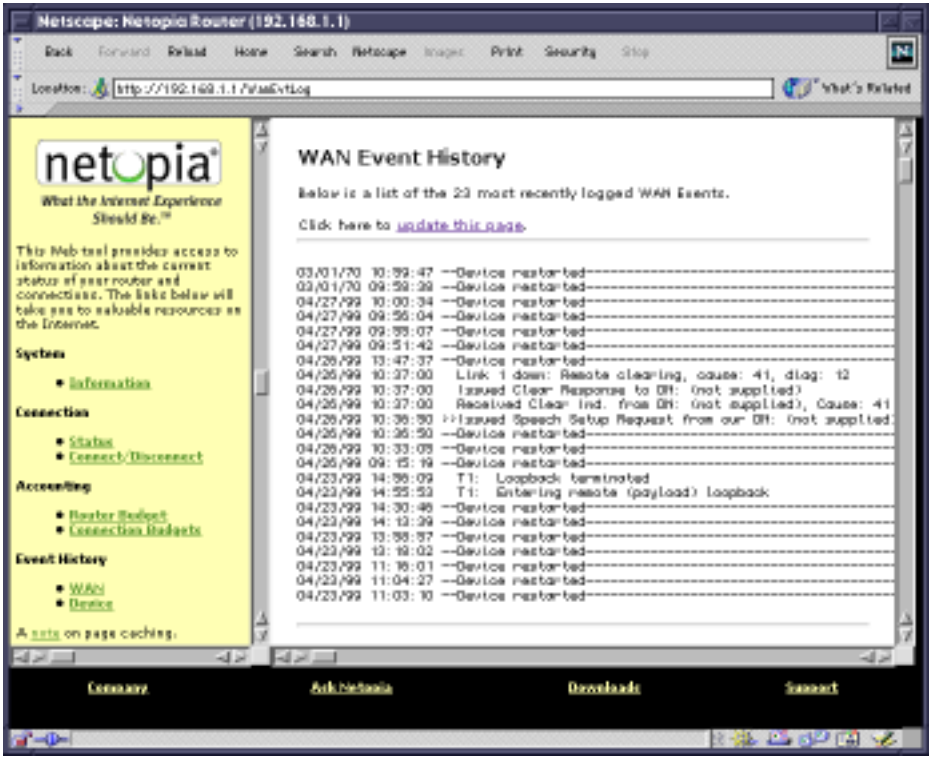
To return to the Connection Budgets page, click the **Go to Budgets** link.

Event History pages

The Netopia R5000 Series Router records certain relevant occurrences in event histories. Event histories are useful for diagnosing problems because they list what happened before, during, and after a problem occurs. You can view two different event histories: one for the router's system and one for the WAN. The Netopia R5000 Series Router's built-in battery backup prevents loss of event history from a shutdown or reset.

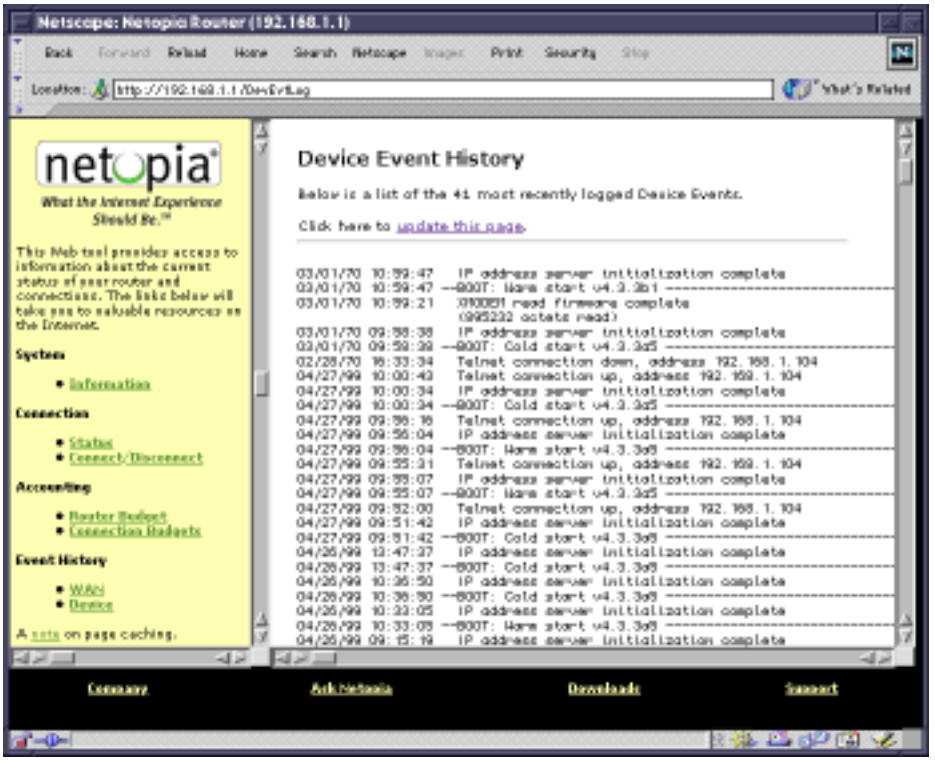
The router's event histories are structured to display the most recent events first and to make it easy to distinguish error messages from informational messages. Error messages are prefixed with an asterisk. Both the WAN Event History and Device Event History pages retain records of up to 128 of the most recent events.

WAN Event History page



You can refresh the WAN Event History log by clicking the **update this page** link.

Device Event History page



You can refresh the Device Event History log by clicking the **update this page** link.

Chapter 13

Security

The Netopia R5000 Series Router provides a number of security features to help protect its configuration screens and your local network from unauthorized access. Although these features are optional, it is strongly recommended that you use them.

This section covers the following topics:

Suggested security measures

In addition to setting up user accounts, Telnet access, and filters (all of which are covered later in this chapter), there are other actions you can take to make the Netopia R5000 Series Router and your network more secure:

- Change the SNMP community strings (or passwords). The default community strings are universal and could easily be known to a potential intruder.
- Set the answer profile so it must match incoming calls to a connection profile.
- Leave the Enable Dial-in Console Access option set to No.
- When using AURP, accept connections only from configured partners.
- Configure the Netopia R5000 Series Router through the serial console port to ensure that your communications cannot be intercepted.

User accounts

When you first set up and configure the Netopia R5000 Series Router, no passwords are required to access the configuration screens. Anyone could tamper with the router's configuration by simply connecting it to a console.

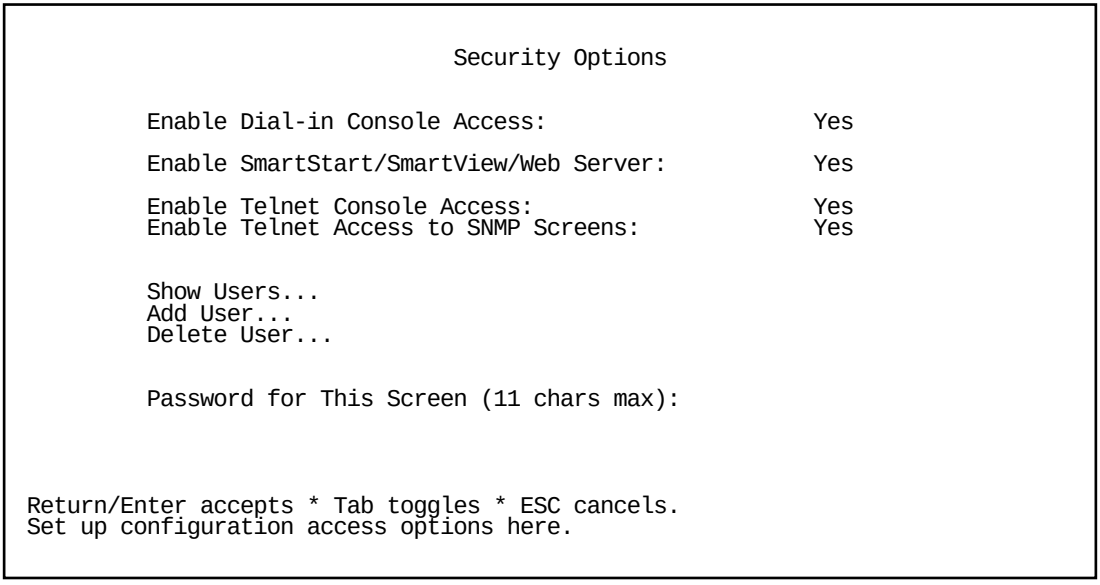
However, by adding user accounts, you can protect the most sensitive screens from unauthorized access. User accounts are composed of name/password combinations that can be given to authorized users.

Caution!

You are strongly encouraged to add protection to the configuration screens. Unprotected screens could allow an unauthorized user to compromise the operation of your entire network.

Once user accounts are created, users who attempt to access protected screens will be challenged. Users who enter an incorrect name or password are returned to a screen requesting a name/password combination to access the Main Menu.

To set up user accounts, in the System Configuration screen select **Security** and press Return. The Security Options screen appears.



Protecting the Security Options screen

The first screen you should protect is the Security Options screen, because it controls access to the configuration screens. Access to the Security Options screen can be protected with a password.

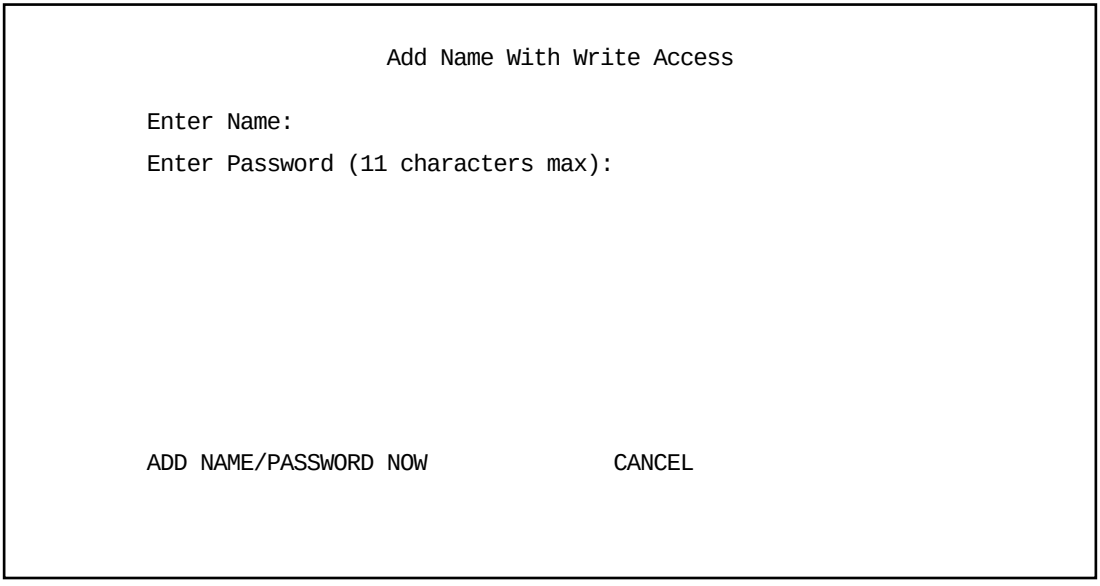
Select **Password for This Screen** in the Security Options screen and enter a password. Make sure this password is secure and is different from any of the user account passwords.

Protecting the configuration screens

You can protect the configuration screens with user accounts. You can administer the accounts from the Security Options screen. You can create up to four accounts.

To display a view-only list of user accounts, select **Show Users** in the Security Options screen.

To add a new user account, select **Add User** in the Security Options screen and press Return. The Add Name With Write Access screen appears.



Follow these steps to configure the new account:

1. Select **Enter Name** and enter a descriptive name (for example, the user's first name).
2. Select **Enter Password** and enter a password.
3. To accept the new name/password combination, select **ADD NAME/PASSWORD NOW** and press Return. To exit the Add Name With Write Access screen without saving the new account, select **CANCEL**. You are returned to the Security Options screen.

To delete a user account, select **Delete User** to display a list of accounts. Select an account from the list and press Return to delete it. To exit the list without deleting the selected account, press Escape.

Dial-in console access

Remote modem terminal emulator setups can dial in to the modem line and establish a remote console session, even though they are not using PPP. This allows Netopia Inc.'s Up and Running, Guaranteed! department or other administrator with the appropriate security to remotely configure your router for you.

- To prevent any remote caller from establishing a remote session, set the option **Enable Dial-in Console Access** set to **No**.
- To allow access for Up and Running, Guaranteed! with the default name and password in place, toggle this option to **Yes**.

Enable SmartStart/SmartView/Web server

You may want to restrict access to the Web-based screens to prevent inadvertent switching or connecting and disconnecting of connection profiles. Since SmartStart can be used to reconfigure the router, you may want to block inadvertent damage resulting from unauthorized use of SmartStart. To prevent access to these features toggle this option to **No**.

Telnet access

Telnet is a TCP/IP service that allows remote terminals to access hosts on an IP network. The Netopia R5000 Series Router supports Telnet access to its configuration screens.

Caution!

You should consider password-protecting or restricting Telnet access to the Netopia R5000 Series Router if you suspect there is a chance of tampering.

To password-protect the configuration screens, select Easy Setup from the Main Menu, and go to the Easy Setup Security Configuration screen. By entering a name and password pair in this screen, all access via serial, Telnet, SNMP, and Web server will be password-protected.

To restrict Telnet access, select **Security** in the Advanced Configuration menu. The Security Options screen will appear. There are two levels of Telnet restriction available:

- To restrict Telnet access to the SNMP screens, select **Enable Telnet Access to SNMP Screens** and toggle it to **No**. (See "SNMP traps" on page 12-15.)
- To restrict Telnet access to all of the configuration screens, select **Enable Telnet Console Access** and toggle it to **No**.

About filters and filter sets

Security should be a high priority for anyone administering a network connected to the Internet. Using packet filters to control network communications can greatly improve your network's security.

The Netopia R5000 Series Router's packet filters are designed to provide security for the Internet connections made to and from your network. You can customize the router's filter sets for a variety of packet filtering applications. Typically, you use filters to selectively admit or refuse TCP/IP connections from certain remote networks and specific hosts. You will also use filters to screen particular types of connections. This is commonly called firewalling your network.

Before creating filter sets, you should read the next few sections to learn more about how these powerful security tools work.

What's a filter and what's a filter set?

A filter is a rule that lets you specify what sort of data can flow in and out of your network. A particular filter can be either an input filter—one that is used on data (packets) coming in to your network from the Internet—or an output filter—one that is used on data (packets) going out from your network to the Internet.

A filter set is a group of filters that work together to check incoming or outgoing data. A filter set can consist of a combination of input and output filters.

How filter sets work

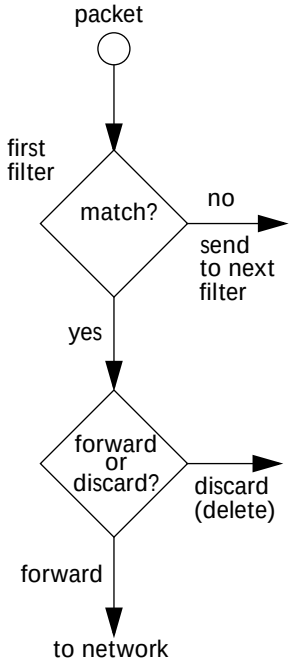
A filter set acts like a team of customs inspectors. Each filter is an inspector through which incoming and outgoing packages must pass. The inspectors work as a team, but each inspects every package individually.

Each inspector has a specific task. One inspector's task may be to examine the destination address of all outgoing packages. That inspector looks for a certain destination—which could be as specific as a street address or as broad as an entire country—and checks each package's destination address to see if it matches that destination.

A filter inspects data packets like a customs inspector scrutinizing packages.

Filter priority

Continuing the customs inspectors analogy, imagine the inspectors lined up to examine a package. If the package matches the first inspector's criteria, the package is either rejected or passed on to its destination, depending on the first inspector's particular orders. In this case, the package is never seen by the remaining inspectors.



If the package does not match the first inspector's criteria, it goes to the second inspector, and so on. You can see that the order of the inspectors in the line is very important.

For example, let's say the first inspector's orders are to send along all packages that come from Rome, and the second inspector's orders are to reject all packages that come from France. If a package arrives from Rome, the first inspector sends it along without allowing the second inspector to see it. A package from Paris is ignored by the first inspector, rejected by the second inspector, and never seen by the others. A package from London is ignored by the first two inspectors, so it's seen by the third inspector.

In the same way, filter sets apply their filters in a particular order. The first filter applied can forward or discard a packet before that packet ever reaches any of the other filters. If the first filter can neither forward nor discard the packet (because it cannot match any criteria), the second filter has a chance to forward or reject it, and so on. Because of this hierarchical structure, each filter is said to have a priority. The first filter has the highest priority, and the last filter has the lowest priority.

How individual filters work

As described above, a filter applies criteria to an IP packet and then takes one of three actions

A filter's actions

- forwards the packet to the local or remote network
- Blocks (discards) the packet
- Ignores the packet

A filter forwards or blocks a packet only if it finds a match after applying its criteria. When no match occurs, the filter ignores the packet.

A filtering rule

The criteria are based on information contained in the packets. A filter is simply a rule that prescribes certain actions based on certain conditions. For example, the following rule qualifies as a filter:

Block all Telnet attempts that originate from the remote host 199.211.211.17.

This rule applies to Telnet packets that come from a host with the IP address 199.211.211.17. If a match occurs, the packet is blocked.

Here is what this rule looks like when implemented as a filter on the Netopia R5000 Series Router:

```
+-#--Source IP Addr--Dest IP Addr-----Proto-Src.Port-D.Port--On?-Fwd-+
+-------------------------------------------------------------------+
| 1  199.211.211.17  0.0.0.0          TCP   23               Yes No  |
+-------------------------------------------------------------------+
```

To understand this particular filter, look at the parts of a filter.

Parts of a filter

A filter consists of criteria based on packet attributes. A typical filter can match a packet on any one of the following attributes:

- The source IP address (where the packet was sent from)
- The destination IP address (where the packet is going)
- The type of higher-layer Internet protocol the packet is carrying, such as TCP or UDP

Port numbers

A filter can also match a packet's port number attributes, but only if the filter's protocol type is set to TCP or UDP, since only those protocols use port numbers. The filter can be configured to match the following:

- The source port number (the port on the sending host that originated the packet)
- The destination port number (the port on the receiving host that the packet is destined for)

By matching on a port number, a filter can be applied to selected TCP or UDP services, such as Telnet, FTP, and World Wide Web. The following tables show a few common services and their associated port numbers.

Internet service	TCP port	Internet service	TCP port
FTP	20/21	Finger	79
Telnet	23	World Wide Web	80
SMTP (mail)	25	News	144
Gopher	70	rlogin	513

Internet service	UDP port	Internet service	UDP port
Who Is	43	AppleTalk Routing Maintenance (at-rtmp)	202
World Wide Web	80	AppleTalk Name Binding (at-nbp)	202
SNMP	161	AURP (AppleTalk)	387
TFTP	69	who	513

Port number comparisons

A filter can also use a comparison option to evaluate a packet's source or destination port number. The comparison options are:

No Compare: No comparison of the port number specified in the filter with the packet's port number.

Not Equal To: For the filter to match, the packet's port number cannot equal the port number specified in the filter.

Less Than: For the filter to match, the packet's port number must be less than the port number specified in the filter.

Less Than or Equal: For the filter to match, the packet's port number must be less than or equal to the port number specified in the filter.

Equal: For the filter to match, the packet's port number must equal the port number specified in the filter.

Greater Than: For the filter to match, the packet's port number must be greater than the port number specified in the filter.

Greater Than or Equal: For the filter to match, the packet's port number must be greater than or equal to the port number specified in the filter.

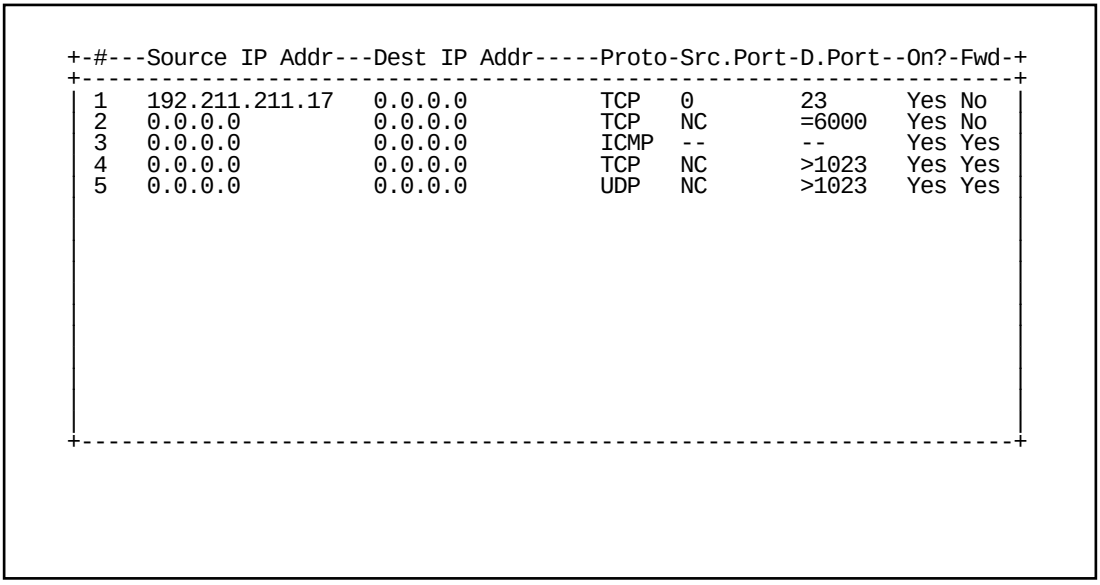
Other filter attributes

There are three other attributes to each filter:

- The filter's order (i.e., priority) in the filter set
- Whether the filter is currently active
- Whether the filter is set to forward packets or to block (discard) packets

Putting the parts together

When you display a filter set, its filters are displayed as rows in a table:



```
+-#---Source IP Addr---Dest IP Addr-----Proto-Src.Port-D.Port--On?-Fwd-+
+-------------------------------------------------------------------+
| 1   192.211.211.17   0.0.0.0          TCP   0        23      Yes No  |
| 2   0.0.0.0          0.0.0.0          TCP   NC       =6000   Yes No  |
| 3   0.0.0.0          0.0.0.0          ICMP  --       --      Yes Yes |
| 4   0.0.0.0          0.0.0.0          TCP   NC       >1023   Yes Yes |
| 5   0.0.0.0          0.0.0.0          UDP   NC       >1023   Yes Yes |
|                                                                   |
|                                                                   |
|                                                                   |
|                                                                   |
|                                                                   |
|                                                                   |
|                                                                   |
|                                                                   |
+-------------------------------------------------------------------+
```

The table's columns correspond to each filter's attributes:

#: The filter's priority in the set. Filter number 1, with the highest priority, is first in the table.

Source IP Addr: The packet source IP address to match.

Dest IP Addr: The packet destination IP address to match.

Proto: The protocol to match. This can be entered as a number (see the table below) or as TCP or UDP if those protocols are used.

Protocol	Number to use	Full name
N/A	0	Ignores protocol type
ICMP	1	Internet Control Message Protocol
TCP	6	Transmission Control Protocol
UDP	17	User Datagram Protocol

Src. Port: The source port to match. This is the port on the sending host that originated the packet.

D. Port: The destination port to match. This is the port on the receiving host for which the packet is intended.

On?: Displays **Yes** when the filter is in effect or **No** when it is not.

Fwd: Shows whether the filter forwards (**Yes**) a packet or discards (**No**) it when there's a match.

Filtering example #1

Returning to our filtering rule example from above (see page 13-7), look at how a rule is translated into a filter. Start with the rule, then fill in the filter's attributes:

1. The rule you want to implement as a filter is:

   Block all Telnet attempts that originate from the remote host 199.211.211.17.

2. The host 199.211.211.17 is the source of the Telnet packets you want to block, while the destination address is any IP address. How these IP addresses are masked determines what the final match will be, although the mask is not displayed in the table that displays the filter sets (you set it when you create the filter). In fact, since the mask for the destination IP address is 0.0.0.0, the address for Dest IP Addr could have been anything. The mask for Source IP Addr must be 255.255.255.255 since an exact match is desired.

   - Source IP Addr = 199.211.211.17
   - Source IP address mask = 255.255.255.255
   - Dest IP Addr = 0.0.0.0
   - Destination IP address mask = 0.0.0.0

   Note: To learn about IP addresses and masks, see Appendix B, "Understanding IP Addressing."

3. Using the tables on page 13-8, find the destination port and protocol numbers (the *local* Telnet port):

   - Proto = TCP (or 6)
   - D. Port = 23

4. The filter should be enabled and instructed to block the Telnet packets containing the source address shown in step 2:

   - On? = Yes
   - Fwd = No

This four-step process is how we produced the following filter from the original rule:

```
+-#---Source IP Addr---Dest IP Addr-----Proto-Src.Port-D.Port--On?-Fwd-+
+-------------------------------------------------------------------+
| 1   192.211.211.17   0.0.0.0          TCP   0        23      Yes No  |
|                                                                     |
+-------------------------------------------------------------------+
```

Filtering example #2

Suppose a filter is configured to block all incoming IP packets with the source IP address of 200.233.14.0, regardless of the type of connection or its destination. The filter would look like this:

```
+-#---Source IP Addr---Dest IP Addr-----Proto-Src.Port-D.Port--On?-Fwd-+
+-------------------------------------------------------------------+
| 1   200.233.14.0     0.0.0.0               0               Yes No  |
|                                                                   |
+-------------------------------------------------------------------+
```

This filter blocks any packets coming from a remote network with the IP network address 200.233.14.0. The 0 at the end of the address signifies *any* host on the class C IP network 200.233.14.0. If, for example, the filter is applied to a packet with the source IP address 200.233.14.5, it will block it.

In this case, the mask, which does not appear in the table, must be set to 255.255.255.0. This way, all packets with a source address of 200.233.14.x will be matched correctly, no matter what the final address byte is.

Note: The protocol attribute for this filter is 0 by default. This tells the filter to ignore the IP protocol or type of IP packet.

Design guidelines

Careful thought must go into designing a new filter set. You should consider the following guidelines:

- Be sure the filter set's overall purpose is clear from the beginning. A vague purpose can lead to a faulty set, and that can actually make your network *less* secure.
- Be sure each individual filter's purpose is clear.
- Determine how filter priority will affect the set's actions. Test the set (on paper) by determining how the filters would respond to a number of different hypothetical packets.
- Consider the combined effect of the filters. If every filter in a set fails to match on a particular packet, the packet is:
  - Forwarded if all the filters are configured to discard (*not* forward)
  - Discarded if all the filters are configured to forward
  - Discarded if the set contains a combination of forward and discard filters

Disadvantages of filters

Although using filter sets can greatly enhance network security, there are disadvantages:

- Filters are complex. Combining them in filter sets introduces subtle interactions, increasing the likelihood of implementation errors.
- Enabling a large number of filters can have a negative impact on performance. Processing of packets will take longer if they have to go through many checkpoints.
- Too much reliance on packet filters can cause too little reliance on other security methods. Filter sets are *not* a substitute for password protection, effective safeguarding of passwords, caller ID, the "must match"

option in the answer profile, PAP or CHAP in connection profiles, callback, and general awareness of how your network may be vulnerable.

An approach to using filters

The ultimate goal of network security is to prevent unauthorized access to the network without compromising authorized access. Using filter sets is part of reaching that goal.

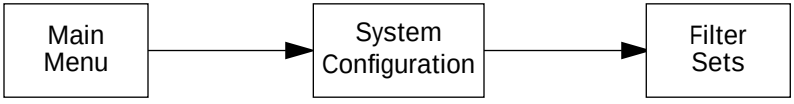
Each filter set you design will be based on one of the following approaches:

- That which is not expressly prohibited is permitted.
- That which is not expressly permitted is prohibited.

It is strongly recommended that you take the latter, and safer, approach to all of your filter set designs.

Working with IP filters and filter sets

This section covers IP filters and filter sets. For working with IPX filters and filter sets, see "IPX filters" on page 13-23.



To work with filters and filter sets, begin by accessing the filter set screens.

Note: Make sure you understand how filters work before attempting to use them. Read the section "About filters and filter sets," beginning on page 13-4.

```
                                Filter Sets


                        Add Filter Set...
                        Display/Change Filter Set...
                        Delete Filter Set...









Return/Enter to modify an existing Filter Set.
Set Up IP Filter Sets (Firewalls) from this and the following Menus.
```

The procedure for creating and maintaining filter sets is as follows:

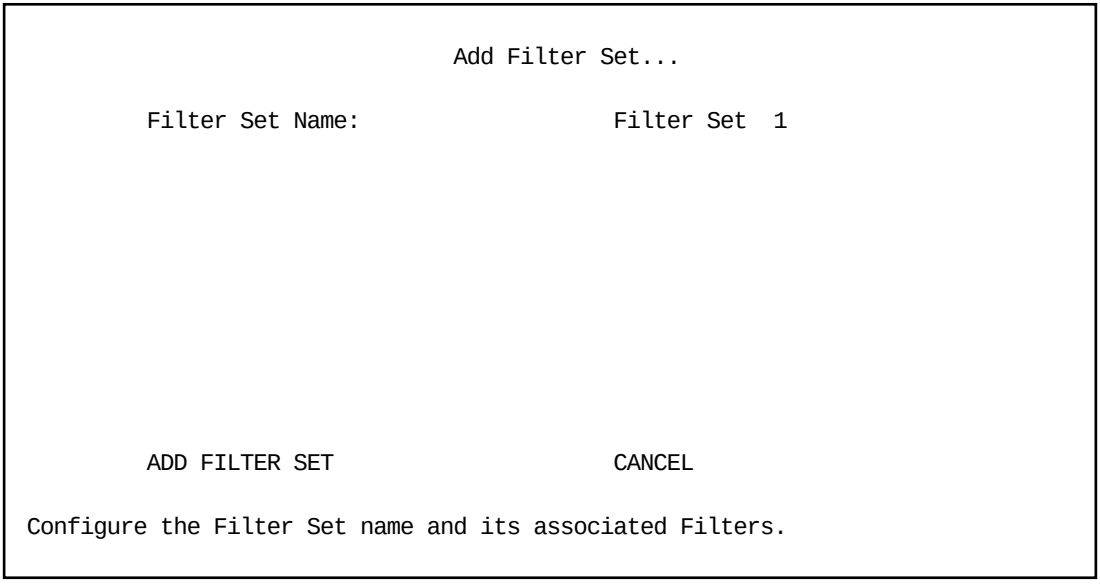
1. Add a new filter set.
2. Create the filters for the new filter set.
3. View, change, or delete individual filters and filter sets.

The following sections explain how to execute these steps.

Adding a filter set

You can create up to 255 filter rules. You can use them in any combination of input or output in up to eight filter sets.

To add a new filter set, select **Add Filter Set** in the Filter Sets screen and press Return. The Add Filter Set screen appears.



Naming a new filter set

All new filter sets have a default name. The first filter set you add will be called Filter Set 1, the next filter will be Filter Set 2, and so on.

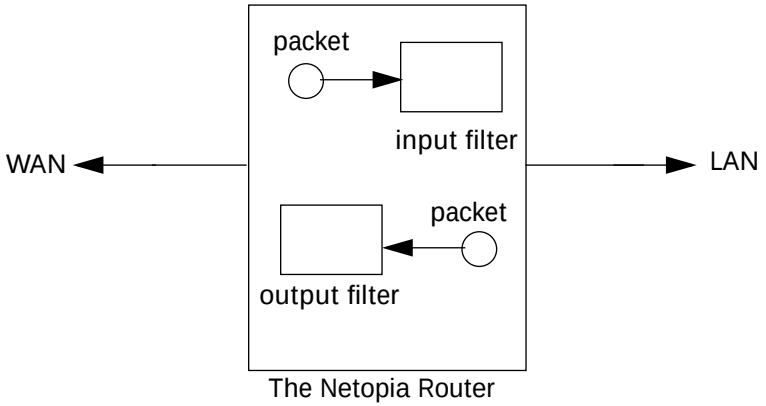
To give a new filter set a different name, select **Filter Set Name** and enter a new name for the filter set.

To save the filter set, select **ADD FILTER SET**. The saved filter set is empty (contains no filters), but you can return to it later to add filters (see “Modifying filter sets” on page 13-19). Or you can add filters to your new set before saving it (see “Adding filters to a filter set” on page 13-14).

To leave the Add Filter Set screen without saving the new filter set select **CANCEL**. You are returned to the Filter Sets screen.

Input and output filters—source and destination

There are two kinds of filters you can add to a filter set: input and output. Input filters check packets received from the Internet, destined for your network. Output filters check packets transmitted from your network to the Internet.



Packets in the Netopia R5000 Series Router pass through an input filter if they originate in the WAN and through an output filter if they're being sent out to the WAN.

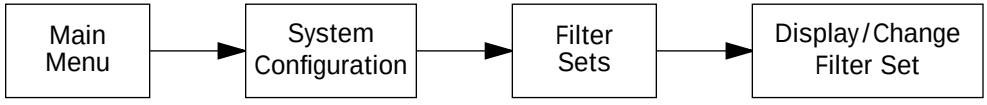
The process for adding input and output filters is exactly the same. The main difference between the two involves their reference to source and destination. From the perspective of an input filter, your local network is the destination of the packets it checks, and the remote network is their source. From the perspective of an output filter, your local network is the source of the packets, and the remote network is their destination.

Type of filter	Source means	"Destination" means
Input filter	The remote network	The local network
Output filter	The local network	The remote network

Adding filters to a filter set

In this section you'll learn how to add an input filter to a filter set. Adding an output filter works exactly the same way, providing you keep the different source and destination perspectives in mind.

To add an input filter, navigate to the Display/Change Filter Set screen and select **Display/Change Filter Set**.



A popup menu displays a list of the filter sets you have created.

Select the one you want to edit.

The Display/Change Filter Set screen appears.

```
                          Display/Change Filter Set...

        Filter Set Name:                  Filter Set  1


                    Add Input Filter to Filter Set...
                    Display/Change Input Filter...
                    Delete Input Filter...
                    Move Input Filter...

                    Add Output Filter to Filter Set...
                    Display/Change Output Filter...
                    Delete Output Filter...
                    Move Output Filter...
```

To add an input filter, select **Add Input Filter to Filter Set**.

The Add Filter screen appears. (To add an output filter, select **Add Output Filter**.)

```
                            Add Input Filter

        Enabled:                          Yes
        Forward:                          No


        Source IP Address:                0.0.0.0
        Source IP Address Mask:           0.0.0.0

        Dest. IP Address:                 0.0.0.0
        Dest. IP Address Mask:            0.0.0.0

        Protocol Type:                    UDP
        Source Port Compare...            No Compare
        Source Port ID:                   0
        Dest. Port Compare...             No Compare
        Dest. Port ID:                    0


        ADD THIS FILTER NOW               CANCEL

Return/Enter to set comparison of packet Port ID and Filter Port ID.
Enter the packet specific information for this filter.
```

1. To make the filter active in the filter set, select **Enabled** and toggle it to **Yes**. If **Enabled** is toggled to **No**, the filter can still exist in the filter set, but it will have no effect.

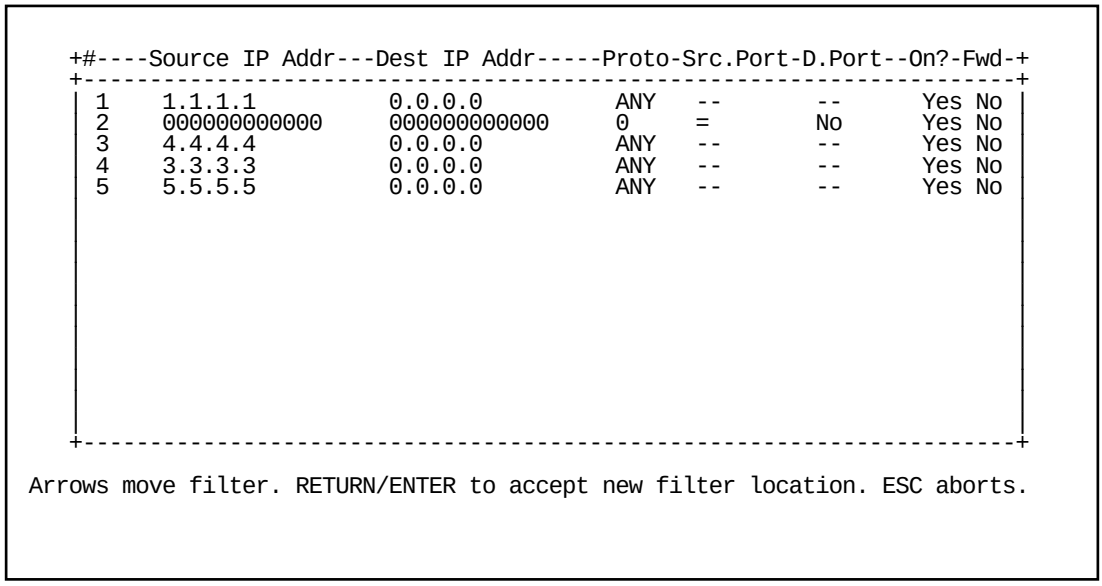
2. If you want the filter to forward packets that match its criteria to the destination IP address, select **Forward** and toggle it to **Yes**. If **Forward** is toggled to **No**, packets matching the filter's criteria will be discarded.
3. Select **Source IP Address** and enter the source IP address this filter will match on. You can enter a subnet or a host address.
4. Select **Source IP Address Mask** and enter a mask for the source IP address. This allows you to further modify the way the filter will match on the source address. Enter 0.0.0.0 to force the filter to match on all source IP addresses, or enter 255.255.255.255 to match the source IP address exclusively.
5. Select **Dest. IP Address** and enter the destination IP address this filter will match on. You can enter a subnet or a host address.
6. Select **Dest. IP Address Mask** and enter a mask for the destination IP address. This allows you to further modify the way the filter will match on the destination address. Enter 0.0.0.0 to force the filter to match on all destination IP addresses.
7. Select **Protocol Type** and enter **ICMP**, **TCP**, **UDP**, **Any**, or the number of another IP transport protocol (see the table on page 13-9).

   Note: If Protocol Type is set to TCP or UDP, the settings for port comparison that you configure in steps 9. and 10. will appear. These settings take effect only if the Protocol Type is TCP or UDP.
8. Select **Protocol Type** and enter **ICMP**, **TCP**, **UDP**, **Any**, or the number of another IP transport protocol (see the table on page 13-9).

   Note: If Protocol Type is set to TCP or UDP, the settings for port comparison that you configure in steps 9. and 10. will appear. These settings only take effect if the Protocol Type is TCP or UDP.
9. Select **Source Port Compare** and choose a comparison method for the filter to use on a packet's source port number. Then select **Source Port ID** and enter the actual source port number to match on (see the table on page 13-8).
10. Select **Dest. Port Compare** and choose a comparison method for the filter to use on a packet's destination port number. Then select **Dest. Port ID** and enter the actual destination port number to match on (see the table on page 13-8).
11. When you are finished configuring the filter, select **ADD THIS FILTER NOW** to save the filter in the filter set. Select **CANCEL** to discard the filter and return to the Add Filter Set screen.

Moving filters

The Move Input/Output Filter permits reordering of rules in a filter set.



All operations are done from a single popup.

- In the Display/Change Filter Set screen, select **Move Input Filter** (or **Move Output Filter**). A selection mode popup appears. In this mode you scroll to the rule you want to move and press Return on a rule to select it for moving.

  The help text tells you what is expected.

- After pressing Return you are in Move mode. Arrow keys move the selected rule up or down. When you press Return again the rule is put in the new location permanently and the popup is dismissed. You can press Escape at any time in the popup to abort the move and restore the filter set to its original ordering.

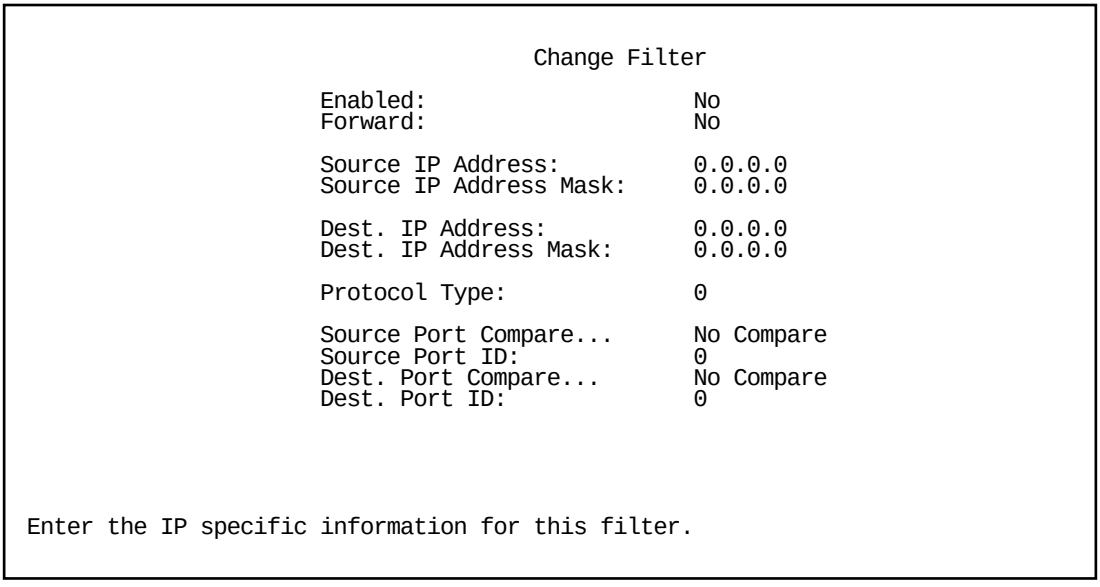
Viewing filters

To display a view-only table of input or output filters, select **Display/Change Input Filter** or **Display/Change Output Filter** in the Display/Change Filter Set screen.

Modifying filters

To modify a filter, select **Display/Change Input Filter** or **Display/Change Output Filter** in the Display/Change Filter Set screen to display a table of filters.

Select a filter from the table and press Return. The Change Filter screen appears. The parameters in this screen are set in the same way as the ones in the Add Filter screen (see “Adding filters to a filter set” on page 13-14).



Deleting filters

To delete a filter, select **Delete Input Filter** or **Delete Output Filter** in the Add Filter Set screen to display a table of filters.

Select the filter from the table and press Return to delete it. Press Escape to exit the table without deleting the filter.

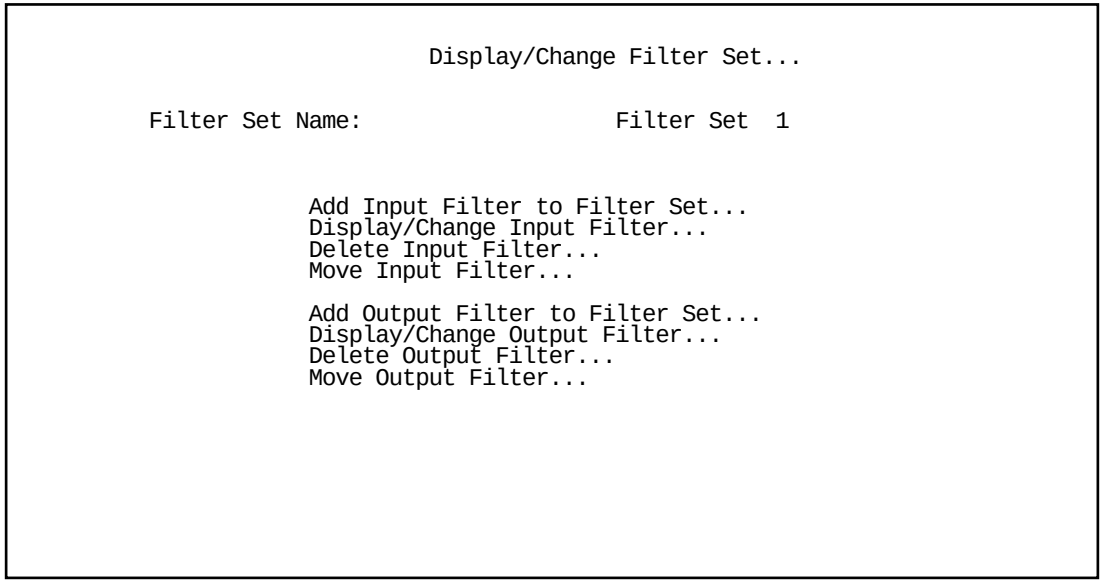
Viewing filter sets

To display a view-only list of filter sets, select **Display / Change Filter Set** in the Filter Sets screen.

Modifying filter sets

To modify a filter set, select **Display / Change Filter Set** in the Filter Sets screen to display a list of filter sets.

Select a filter set from the list and press Return. The Change Filter Set screen appears. The items in this screen are the same as the ones in the Add Filter screen (see “Adding filters to a filter set” on page 13-14).



Deleting a filter set

Note: If you delete a filter set, all of the filters it contains are deleted as well. To reuse any of these filters in another set, before deleting the current filter set you’ll have to note their configuration and then recreate them.

To delete a filter set, select **Delete Filter Set** in the Filter Sets screen to display a list of filter sets.

Select a filter set from the list and press Return to delete it. Press Escape to exit the list without deleting the filter set.

A sample IP filter set

This section contains the settings for a filter set called Basic Firewall, which is part of the Netopia R5000 Series Router’s factory configuration.

Basic Firewall blocks undesirable traffic originating from the WAN (in most cases, the Internet), but forwards all traffic originating from the LAN. It follows the conservative “that which is not expressly permitted is prohibited” approach: unless an incoming packet expressly matches one of the constituent input filters, it will not be forwarded to the LAN.

The five input filters and one output filter that make up Basic Firewall are shown in the table below.

Setting	Input filter 1	Input filter 2	Input filter 3	Input filter 4	Input filter 5	Output filter 1
Enabled	Yes	Yes	Yes	Yes	Yes	Yes
Forward	No	No	Yes	Yes	Yes	Yes
Source IP address	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0
Source IP address mask	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0
Dest. IP address	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0
Dest. IP address mask	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0	0.0.0.0
Protocol type	TCP	TCP	ICMP	TCP	UDP	0
Source port comparison	No Compare	No Compare	N/A	No Compare	No Compare	N/A
Source port ID	0	0	N/A	0	0	N/A
Dest. port comparison	Equal	Equal	N/A	Greater Than	Greater Than	N/A
Dest. port ID	2000	6000	N/A	1023	1023	N/A

Basic Firewall's filters play the following roles.

Input filters 1 and 2: These block WAN-originated OpenWindows and X-Windows sessions. Service origination requests for these protocols use ports 2000 and 6000, respectively. Since these are greater than 1023, OpenWindows and X-Windows traffic would otherwise be allowed by input filter 4. Input filters 1 and 2 must precede input filter 4; otherwise they would have no effect since filter 4 would have already forwarded OpenWindows and X-Windows traffic.

Input filter 3: This filter explicitly forwards all WAN-originated ICMP traffic to permit devices on the WAN to ping devices on the LAN. Ping is an Internet service that is useful for diagnostic purposes.

Input filters 4 and 5: These filters forward all TCP and UDP traffic, respectively, when the destination port is greater than 1023. This type of traffic generally does not allow a remote host to connect to the LAN using one of the potentially intrusive Internet services, such as Telnet, FTP, and WWW.

Output filter 1: This filter forwards all outgoing traffic to make sure that no outgoing connections from the LAN are blocked.

Basic Firewall is suitable for a LAN containing only client hosts that want to access servers on the WAN, but not for a LAN containing servers providing services to clients on the WAN. Basic Firewall's general strategy is to explicitly forward WAN-originated TCP and UDP traffic to ports greater than 1023. Ports lower than 1024 are the service origination ports for various Internet services such as FTP, Telnet, and the World Wide Web (WWW).

A more complicated filter set would be required to provide WAN access to a LAN-based server. See the next section, "Possible modifications," for ways to allow remote hosts to use services provided by servers on the LAN.

Possible modifications

You can modify the sample filter set Basic Firewall to allow incoming traffic using the examples below. These modifications are not intended to be combined. Each modification is to be the only one used with Basic Firewall.

The results of combining filter set modifications can be difficult to predict. It is recommended that you take special care if you are making more than one modification to the sample filter set.

Trusted host. To allow unlimited access by a trusted remote host with the IP address a.b.c.d (corresponding to a numbered IP address such as 163.176.8.243), insert the following input filter ahead of the current input filter 1:

- Enabled: Yes
- Forward: Yes
- Source IP Address: a.b.c.d
- Source IP Address Mask: 255.255.255.255
- Dest. IP Address: 0.0.0.0
- Dest. IP Address Mask: 0.0.0.0
- Protocol Type: 0

Trusted subnet. To allow unlimited access by a trusted remote subnet with subnet address a.b.c.d (corresponding to a numbered IP address such as 163.176.8.0) and subnet mask e.f.g.h (corresponding to a numbered IP mask such as 255.255.255.0), insert the following input filter ahead of the current input filter 1:

- Enabled: Yes
- Forward: Yes
- Source IP Address: a.b.c.d
- Source IP Address Mask: e.f.g.h
- Dest. IP Address: 0.0.0.0
- Dest. IP Address Mask: 0.0.0.0
- Protocol Type: 0

FTP sessions. To allow WAN-originated FTP sessions to a LAN-based FTP server with the IP address a.b.c.d (corresponding to a numbered IP address such as 163.176.8.243), insert the following input filter ahead of the current input filter 1:

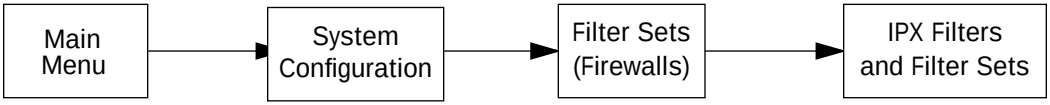
- Enabled: Yes
- Forward: Yes
- Source IP Address: 0.0.0.0
- Source IP Address Mask: 0.0.0.0
- Dest. IP Address: a.b.c.d
- Dest. IP Address Mask: 255.255.255.255
- Protocol Type: TCP
- Source Port Comparison: No Compare
- Source Port ID: 0
- Dest. Port Comparison: Equal
- Dest. Port ID: 21

Note: A similar filter could be used to permit Telnet or WWW access. Set the Dest. Port ID to 23 for Telnet or to 80 for WWW.

AURP tunnel. To allow an AURP tunnel between a remote AURP router with the IP address a.b.c.d (corresponding to a numbered IP address such as 163.176.8.243) and a local AURP router (including the Netopia R5000 Series Router itself), insert the following input filter ahead of the current input filter 1:

- Enabled: Yes
- Forward: Yes
- Source IP Address: a.b.c.d
- Source IP Address Mask: 255.255.255.255
- Dest. IP Address: 0.0.0.0
- Dest. IP Address Mask: 0.0.0.0
- Protocol Type: UDP
- Source Port Comparison: Equal
- Source Port ID: 387
- Dest. Port Comparison: Equal
- Dest. Port ID: 387

IPX filters



IPX packet filters work very similarly to IP packet filters. They filter data traffic coming from or going to remote IPX networks. IPX filters can be set up to forward or discard IPX packets based on a number of user-defined criteria. Like IP filters, IPX filters must be grouped in sets that are applied to the answer profile or to connection profiles.

IPX SAP filters are used for filtering server entries not required to forward over the WAN links. When connecting to a large IPX network via dial-up connection, the transfer of large numbers of SAP entries can consume significant bandwidth on the WAN link.

Note: Using SAP filtering to prevent a server from being advertised does not provide security against that server being accessed—IPX packet filtering must be used for that purpose.

Setting up and using IPX filter sets is a four-step process:

1. Create the filters to use.
2. Create the filter sets to use.
3. Add filters to the filter sets.
4. Attach the filter sets to the answer profile or to connection profiles.

You can configure IPX filters and set up IPX filter sets from the IPX Filters and Filter Sets screen.

```
                        IPX Filters and Filter Sets

                    Display/Change IPX Packet Filters...
                    Add IPX Packet Filter...
                    Delete IPX Packet Filter...

                    Display/Change IPX Packet Filter Sets...
                    Add IPX Packet Filter Set...
                    Delete IPX Packet Filter Set...

                    Display/Change IPX Sap Filters...
                    Add IPX Sap Filter...
                    Delete IPX Sap Filter...

                    Display/Change IPX Sap Filter Sets...
                    Add IPX Sap Filter Set...
                    Delete IPX Sap Filter Set...



Define your filters 1st. IPX Filter Sets refer to, but don't contain, filters.
```

The items in the IPX Filters and Filter Sets screen are grouped into four areas:

- IPX packet filters
- IPX packet filter sets
- IPX SAP filters
- IPX SAP filter sets

The following sections explain the items in each of these areas.

IPX packet filters

For each IPX packet filter, you can configure a set of parameters to match on the source or destination attributes of IPX data packets coming from or going to the WAN.

Viewing and modifying packet filters

To display a view-only table of IPX packet filters, select **Display / Change IPX Packet Filters** in the IPX Filters and Filter Sets screen.

To modify any of the filters in the table, note the desired filter and press Return to go to the Change Packet Filter screen. The parameters in this screen are the same as the ones in the Add Packet Filter screen (see the next section).

Adding a packet filter

To add a new IPX packet filter, select **Add IPX Packet Filter** in the IPX Filters and Filter Sets screen and press Return. The Add Packet Filter screen appears.

```
                        Add Packet Filter

          Filter Name:                                IPX Filter 1

          Source Network:                             00000000
          Source Node Address:                        000000000000
          Source Socket:                              0000

          Destination Network:                        00000000
          Destination Node Address:                   000000000000
          Destination Socket:                         0000









          ADD FILTER NOW                              CANCEL

Configure a new IPX Packet Filter. Finished?  ADD or CANCEL to exit.
```

By default, the filter's socket numbers and network and node addresses are null (all zeros). This sets the filter to match on any IPX data packet. Configure the filter using criteria that meet your security needs.

1. Select **Filter Name** and enter a descriptive name for the filter.
2. To specify a source network for the filter to match on, select **Source Network** and enter an IPX network address.
3. To specify a source node for the filter to match on, select **Source Node Address** and enter an IPX node address.
4. To specify a source socket for the filter to match on, select **Source Socket** and enter an IPX source socket number.
5. To specify a destination network for the filter to match on, select **Destination Network** and enter an IPX network address.
6. To specify a destination node for the filter to match on, select **Destination Node Address** and enter an IPX node address.
7. To specify a destination socket for the filter to match on, select **Destination Socket** and enter an IPX destination socket number.
8. Select **ADD FILTER NOW** to save the current filter. Select **CANCEL** to exit the Add Packet Filter screen without saving the new filter.

Deleting a packet filter

To delete a packet filter, select **Delete IPX Packet Filter** in the IPX Filters and Filter Sets screen to display a table of filters. Select a filter from the table and press Return to delete it. Press the Escape key to exit the table without deleting the filter.

IPX packet filter sets

Before the individual filters can be used, IPX packet filters must be grouped into sets. A filter can be part of more than one filter set.

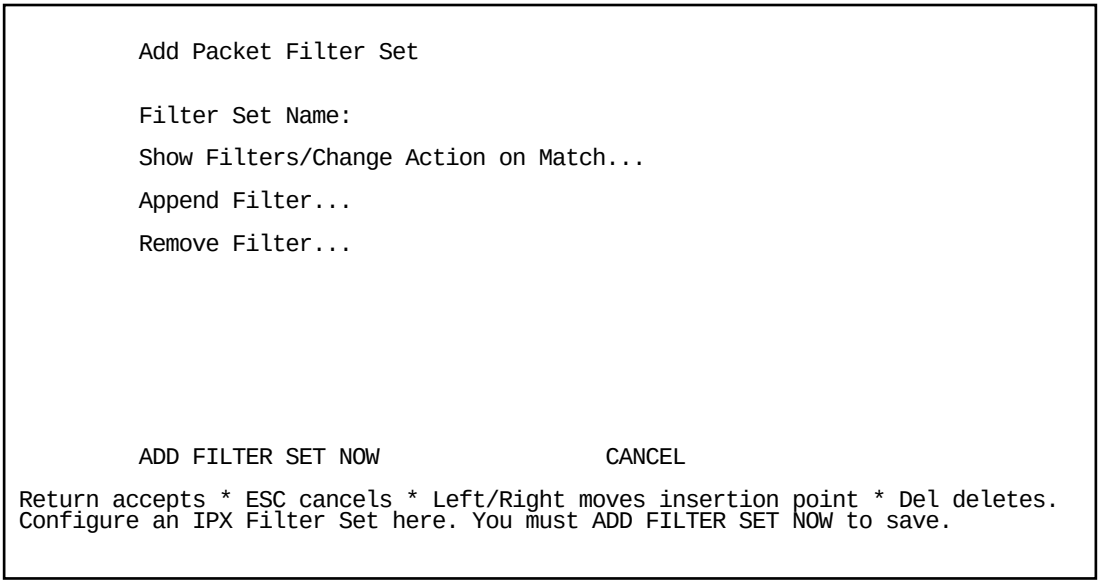
Viewing and modifying packet filter sets

To display a table of IPX packet filter sets, select **Display / Change IPX Packet Filter Sets** in the IPX Filters and Filter Sets screen.

To modify any of the filter sets in the list, select the desired filter set and press Return to go to the Change Packet Filter Set screen. The parameters in this screen are the same as the ones in the Add Packet Filter Set screen (see the next section).

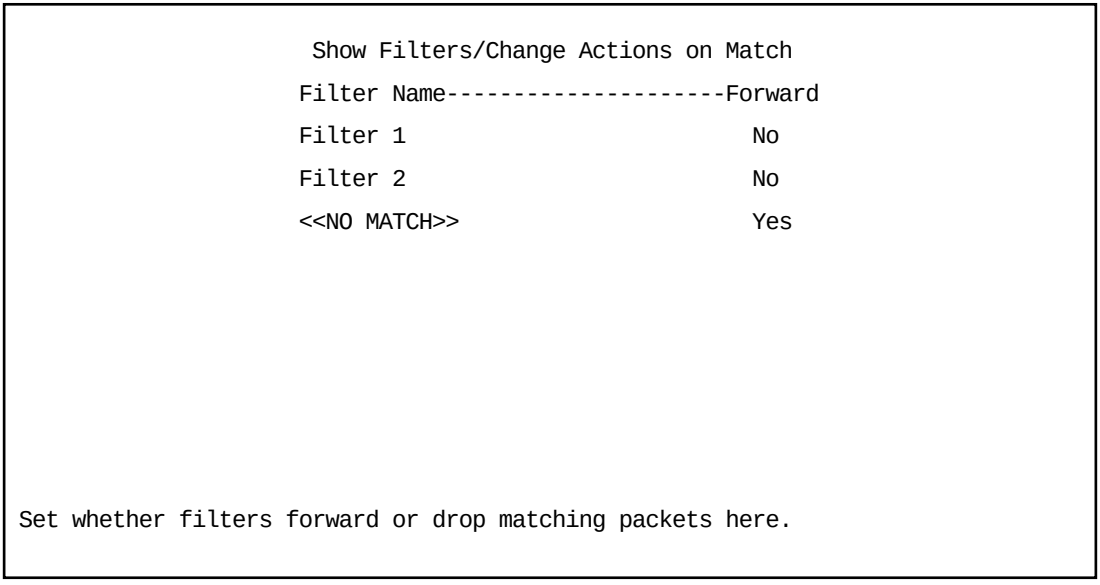
Adding a packet filter set

To add a new IPX packet filter set, select **Add IPX Packet Filter Set** in the IPX Filters and Filter Sets screen and press Return. The Add Packet Filter Set screen appears.



Follow these steps to configure the new packet filter set:

1. Select **Filter Set Name** and enter a descriptive name for the filter set.
2. To change the forwarding action of filters in the filter set, select **Show Filters/Change Action on Match** and press Return. The Show Filters/Change Actions on Match screen appears.



Select a filter and toggle the packet forwarding action to **Yes** (forward) or **No** (discard).

3. To add a filter to the filter set, select **Append Filter** to display a table of filters. Select a filter from the table and press Return to add it to the filter set. The default action of newly added filters is to *not* forward packets that match their criteria.

   To exit the table without adding the filter, press Escape.

4. To remove a filter from the filter set, select **Remove Filter** to display a table of appended filters. Select a filter from the table and press Return to remove it from the set. To exit the table without removing the filter, press Escape.

5. Select **ADD FILTER SET NOW** to save the current filter set. Select **CANCEL** to exit the Add Packet Filter Set screen without saving the new filter set.

Deleting a packet filter set

To delete a packet filter set, select **Delete IPX Packet Filter Set** in the IPX Filters and Filter Sets screen to display a list of filter sets. Select a filter set from the list and press Return to delete it. Press the Escape key to exit the list without deleting the filter set.

Note: Deleting a filter set does not delete the filters in that set. However, the filters in the deleted set are no longer in effect (unless they are part of another set). The deleted set will no longer appear in the answer profile or any connection profiles to which it was added.

IPX SAP filters

For each IPX SAP filter, you can configure a set of parameters to match on certain attributes of IPX SAP packet entries. The filters check IPX SAP packets for entries that match and then acts on those entries. The SAP packets themselves are always allowed to continue after their entries are checked.

The purpose of filtering SAP packets is not to make your network more secure, but to add efficiency to network bandwidth use. Filtering SAP packets may reduce the size of SAP packets and SAP bindery tables by removing unwanted entries.

Viewing and modifying SAP filters

To display a table of IPX SAP filters, select **Display / Change IPX SAP Filters** in the IPX Filters and Filter Sets screen.

To modify any of the filters in the table, select the desired filter and press Return. The Change SAP Filter screen appears. The parameters in this screen are the same as the ones in the Add SAP Filter screen (see the next section).

Adding a SAP filter

To add a new IPX SAP filter, select **Add IPX SAP Filter** in the IPX Filters and Filter Sets screen and press Return. The Add SAP Filter screen appears.

```
                        Add Sap Filter

          Filter Name:

          Server Name:

          Socket:                                       0000

          Type:                                         0000

          IPX Network:                                  00000000
          IPX Node Address:                             000000000000




          ADD FILTER NOW                                CANCEL

Configure a new IPX SAP Filter. Finished?  ADD or CANCEL to exit.
```

By default, the filter's socket and type numbers and network and node addresses are null (all zeros). This sets the filter to match on any IPX SAP packet entry. Configure the filter using criteria that meet your needs.

Follow these steps to configure the new SAP filter:

1. Select **Filter Name** and enter a descriptive name for the filter.
2. To specify a server name for the filter to match on, select **Server Name** and enter the name of an IPX server. You can use the wildcard characters * (asterisk) and ? (question mark). Use * to match any string, including a null string (no characters), and ? to match any single character in the server's name. For example, the filter could match on the server name "NETOPIA" with "NETO*", "NETO?IA", and "NETOPIA*".
3. To specify a socket for the filter to match on, select **Socket** and enter an IPX socket number.
4. To specify a type number for the filter to match on, select **Type** and enter an IPX type number.
5. To specify an IPX network address for the filter to match on, select **IPX Network** and enter an IPX network address.
6. To specify an IPX node address for the filter to match on, select **IPX Node Address** and enter an IPX node address.
7. Select **ADD FILTER NOW** to save the current filter. Select **CANCEL** to exit the Add SAP Filter screen without saving the new filter.

Deleting a SAP filter

To delete a SAP filter, select **Delete IPX SAP filter** in the IPX Filters and Filter Sets screen to display a table of filters. Select a filter from the table and press Return to delete it. Press Escape to exit the table without deleting the filter.

IPX SAP filter sets

Before IPX SAP filters can be used, they must be grouped into sets. A SAP filter can be part of more than one filter set.

Viewing and modifying SAP filter sets

To display a table of IPX SAP filter sets, select **Display/Change IPX SAP Filter Sets** in the IPX Filters and Filter Sets screen to display a list of filter sets.

To modify any of the filter sets in the list, select the desired filter set and go to the Change SAP Filter Set screen. The parameters in this screen are the same as the ones in the Add SAP Filter Set screen (see the next section).

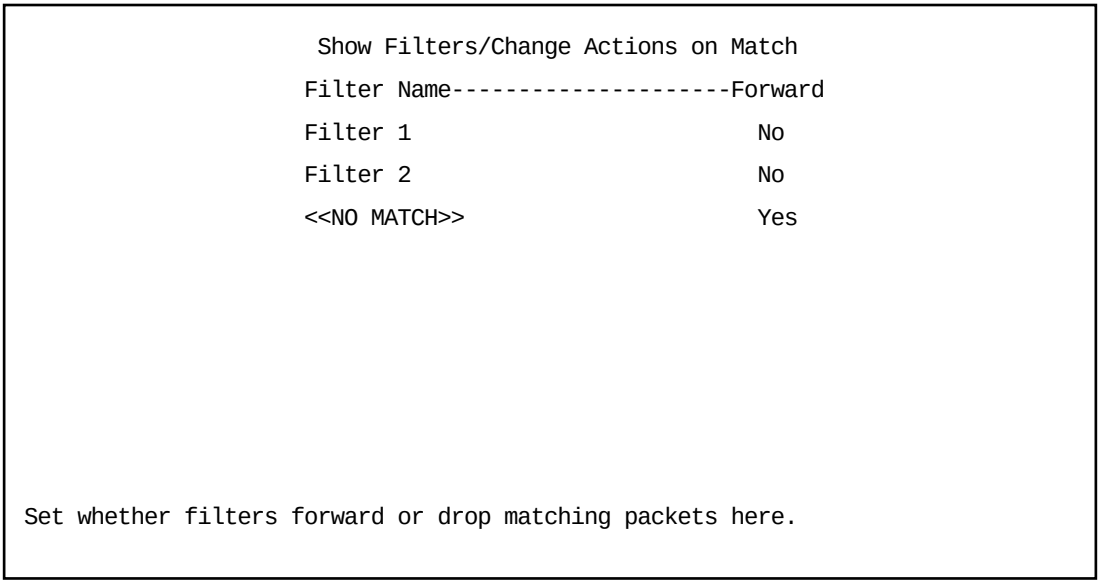
Adding a SAP filter set

To add a new IPX SAP filter set, select **Add IPX SAP Filter Set** in the IPX Filters and Filter Sets screen. The Add SAP Filter Set screen appears.

```
        Add SAP Filter Set

        Filter Set Name:
        Show Filters/Change Action on Match...
        Append Filter...
        Remove Filter...




        ADD FILTER SET NOW                          CANCEL
Configure an IPX Filter Set here. You must ADD FILTER SET NOW to save.
```

Follow these steps to configure the new SAP filter set:

1. Select **Filter Set Name** and enter a descriptive name for the filter set.
2. To change the forwarding action of filters in the filter set, select **Show Filters/Change Action on Match** and press Return. The Show Filters/Change Actions on Match screen appears.



Select a filter and toggle the entry forwarding action to **Yes** (forward) or **No** (discard).

3. To add a filter to the filter set, select **Append Filter** in the Add SAP Filter Set screen to display a table of filters. Select a filter from the table and press Return to add it to the filter set. The default action of newly added filters is to *not* forward (discard) packet entries that match their criteria.

   To exit the table without adding the filter, press Escape.

4. To remove a filter from the filter set, select **Remove Filter** in the Add SAP Filter Set screen to display a table of appended filters. Select a filter from the table and press Return to remove it from the set. To exit the table without removing the filter, press Escape.

5. To save the current filter set, select **ADD FILTER SET NOW** in the Add SAP Filter Set screen. Select **CANCEL** to exit the Add SAP Filter Set screen without saving the new filter set.

Deleting a SAP filter set

To delete a SAP filter set, select **Delete IPX SAP Filter Set** in the IPX Filters and Filter Sets screen to display a list of filter sets. Select a filter set from the list and press Return to delete it. Press Escape to exit the list without deleting the filter set.

Note: Deleting a filter set does not delete the filters in that set. However, the filters in the deleted set are no longer in effect (unless they are part of another set). The deleted set will no longer appear in the answer profile or any connection profiles to which it was added.

Firewall tutorial

General firewall terms

Filter rule: A filter set is comprised of individual filter rules.

Filter set: A grouping of individual filter rules.

Firewall: A component or set of components that restrict access between a protected network and the Internet, or between two networks.

Host: A workstation on the network.

Packet: Unit of communication on the Internet.

Packet filter: Packet filters allow or deny packets based on source or destination IP addresses, TCP or UDP ports, or the TCP ACK bit.

Port: A number that defines a particular type of service.

Basic IP packet components

All IP packets contain the same basic header information, as follows:

Source IP Address	163.176.132.18
Destination IP Address	163.176.4.27
Source Port	2541
Destination Port	80
Protocol	TCP
ACK Bit	Yes
DATA	User Data

This header information is what the packet filter uses to make filtering decisions. It is important to note that a packet filter does not look into the IP data stream (the User Data from above) to make filtering decisions.

Basic protocol types

TCP: Transmission Control Protocol. TCP provides reliable packet delivery and has a retransmission mechanism (so packets are not lost). RFC 793 is the specification for TCP.

UDP: User Datagram Protocol. Unlike TCP, UDP does not guarantee reliable, sequenced packet delivery. If data does not reach its destination, UDP does not retransmit the data. RFC 768 is the specification for UDP.

There are many more ports defined in the Assigned Addresses RFC. The table that follows shows some of these port assignments.

Example TCP/UDP Ports

TCP Port	Service
20/21	FTP
23	Telnet
25	SMTP
80	WWW
144	News

UDP Port	Service
161	SNMP
69	TFTP
387	AURP

Firewall design rules

There are two basic rules to firewall design:

- "What is not explicitly allowed is denied."

and

- "What is not explicitly denied is allowed."

The first rule is far more secure and is the best approach to firewall design. It is far easier (and more secure) to allow in or out only certain services and deny anything else. If the other rule is used, you would have to figure out everything that you want to disallow, now and in the future.

Firewall Logic

Firewall design is a test of logic, and filter rule ordering is critical. If a packet is forwarded through a series of filter rules and then the packet matches a rule, the appropriate action is taken. The packet will not forward through the remainder of the filter rules.

For example, if you had the following filter set...

Allow WWW access;

Allow FTP access;

Allow SMTP access;

Deny all other packets.

and a packet goes through these rules destined for FTP, the packet would forward through the first rule (WWW), go through the second rule (FTP), and match this rule; the packet is allowed through.

If you had this filter set for example....

Allow WWW access;

Allow FTP access;

Deny FTP access;

Deny all other packets.

and a packet goes through these rules destined for FTP, the packet would forward through the first filter rule (WWW), match the second rule (FTP), and the packet is allowed through. Even though the next rule is to deny all FTP traffic, the FTP packet will never make it to this rule.

Binary representation

It is easiest when doing filtering to convert the IP address and mask in question to binary. This will allow you to perform the logical AND to determine whether a packet matches a filter rule.

Logical AND function

When a packet is compared (in most cases) a logical AND function is performed. First the IP addresses and subnet masks are converted to binary and then combined with AND. The rules for the logical use of AND are as follows:

0 AND 0 = 0

0 AND 1 = 0

1 AND 0 = 0

1 AND 1 = 1

For example:

Filter rule:

Deny

IP: 163.176.1.15BINARY: 10100011.10110000.00000001.00001111

Mask: 255.255.255.255BINARY:11111111.11111111.11111111.11111111

Incoming Packet:

IP 163.176.1.15BINARY: 10100011.10110000.00000001.00001111

If you put the incoming packet and subnet mask together with AND, the result is:

10100011.10110000.00000001.00001111

which matches the IP address in the filter rule and the packet is denied.

Implied rules

With a given set of filter rules, there is an implied rule that may or may not be shown to the user. The implied rule tells the filter set what to do with a packet that does not match any of the filter rules. An example of implied rules is as follows:

Implied	Meaning
Y+Y+Y=N	If all filter rules are YES, the implied rule is NO.
N+N+N=Y	If all filter rules are NO, the implied rule is YES.
Y+N+Y=N	If a mix of YES and NO filters, the implied rule is NO.

Established connections

The TCP header contains one bit called the ACK bit (or TCP Ack bit). This ACK bit appears only with TCP, not UDP. The ACK bit is part of the TCP mechanism that guarantees the delivery of data. The ACK bit is set whenever one side of a connection has received data from the other side. Only the first TCP packet will not have the ACK bit set; once the TCP connection is in place, the remainder of the TCP packets with have the ACK bit set.

The ACK bit is helpful for firewall design and reduces the number of potential filter rules. A filter rule could be created just allowing incoming TCP packets with the ACK bit set, since these packets had to be originated from the local network.

Example IP filter set screen

This is an example of the Netopia IP filter set screen:

```
                              Change Filter

         Enabled:                          Yes
         Forward:                          No

         Source IP Address:                0.0.0.0
         Source IP Address Mask:           0.0.0.0

         Dest. IP Address:                 0.0.0.0
         Dest. IP Address Mask:            0.0.0.0

         Protocol Type:                    TCP

         Source Port Compare...            No Compare
         Source Port ID:                   0
         Dest. Port Compare...             Equal
         Dest. Port ID:                    2000
         Established TCP Conns. Only:      No


Return/Enter accepts * Tab toggles * ESC cancels.
Enter the IP specific information for this filter.
```

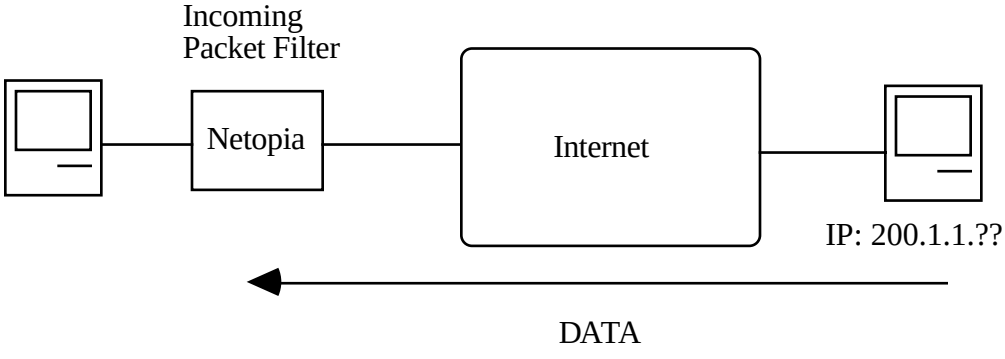
Filter basics

In the source or destination IP address fields, the IP address that is entered must be the network address of the subnet. A host address can be entered, but the applied subnet mask must be 32 bits (255.255.255.255).

The Netopia R5000 Series Router has the ability to compare source and destination TCP or UDP ports. These options are as follows:

Item	What it means
No Compare	Does not compare TCP or UDP port
Not Equal To	Matches any port other than what is defined
Less Than	Anything less than the port defined
Less Than or Equal	Any port less than or equal to the port defined
Equal	Matches only the port defined
Greater Than or Equal	Matches the port or any port greater
Greater Than	Matches anything greater than the port defined

Example network



Example filters

Example 1

Filter Rule:	200.1.1.0	(Source IP Network Address)
	255.255.255.128	(Source IP Mask)
	Forward = No	(What happens on match)

Incoming packet has the source address of 200.1.1.28

IP Address	Binary Representation	
200.1.1.28	00011100	(Source address in incoming IP packet)
AND		
255.255.255.128	10000000	(Perform the logical AND)
	00000000	(Logical AND result)

This incoming IP packet has a source IP address that matches the network address in the Source IP Address field (00000000) in the Netopia R5000 Series Router. This will *not* forward this packet.

Example 2

Filter Rule:	200.1.1.0	(Source IP Network Address)
	255.255.255.128	(Source IP Mask)
	Forward = No	(What happens on match)

Incoming packet has the source address of 200.1.1.184.

IP Address	Binary Representation	
200.1.1.184	10111000	(Source address in incoming IP packet)
AND		
255.255.255.128	10000000	(Perform the logical AND)
	10000000	(Logical AND result)

This incoming IP packet (10000000) has a source IP address that does not match the network address in the Source IP Address field (00000000) in the Netopia R5000 Series Router. This rule *will* forward this packet because the packet does not match.

Example 3

Filter Rule:	200.1.1.96	(Source IP Network Address)
	255.255.255.240	(Source IP Mask)
	Forward = No	(What happens on match)

Incoming packet has the source address of 200.1.1.184.

IP Address	Binary Representation	
200.1.1.184	10111000	(Source address in incoming IP packet)
AND		
255.255.255.240	11110000	(Perform the logical AND)
	10110000	(Logical AND result)

Since the Source IP Network Address in the Netopia R5000 Series Router is 01100000, and the source IP address after the logical AND is 1011000, this rule does *not* match and this packet will be forwarded.

Example 4

Filter Rule:	200.1.1.96	(Source IP Network Address)
	255.255.255.240	(Source IP Mask)
	Forward = No	(What happens on match)

Incoming packet has the source address of 200.1.1.104.

IP Address	Binary Representation	
200.1.1.104	01101000	(Source address in incoming IP packet)
AND		
255.255.255.240	11110000	(Perform the logical AND)
	01100000	(Logical AND result)

Since the Source IP Network Address in the Netopia R5000 Series Router is 01100000, and the source IP address after the logical AND is 01100000, this rule *does* match and this packet will *not* be forwarded.

Example 5

Filter Rule:	200.1.1.96	(Source IP Network Address)
	255.255.255.255	(Source IP Mask)
	Forward = No	(What happens on match)

Incoming packet has the source address of 200.1.1.96.

IP Address	Binary Representation	
200.1.1.96	01100000	(Source address in incoming IP packet)
AND		
255.255.255.255	11111111	(Perform the logical AND)
	01100000	(Logical AND result)

Since the Source IP Network Address in the Netopia R5000 Series Router is 01100000, and the source IP address after the logical AND is 01100000, this rule *does* match and this packet will *not* be forwarded. This rule masks off a *single* IP address.

Chapter 14

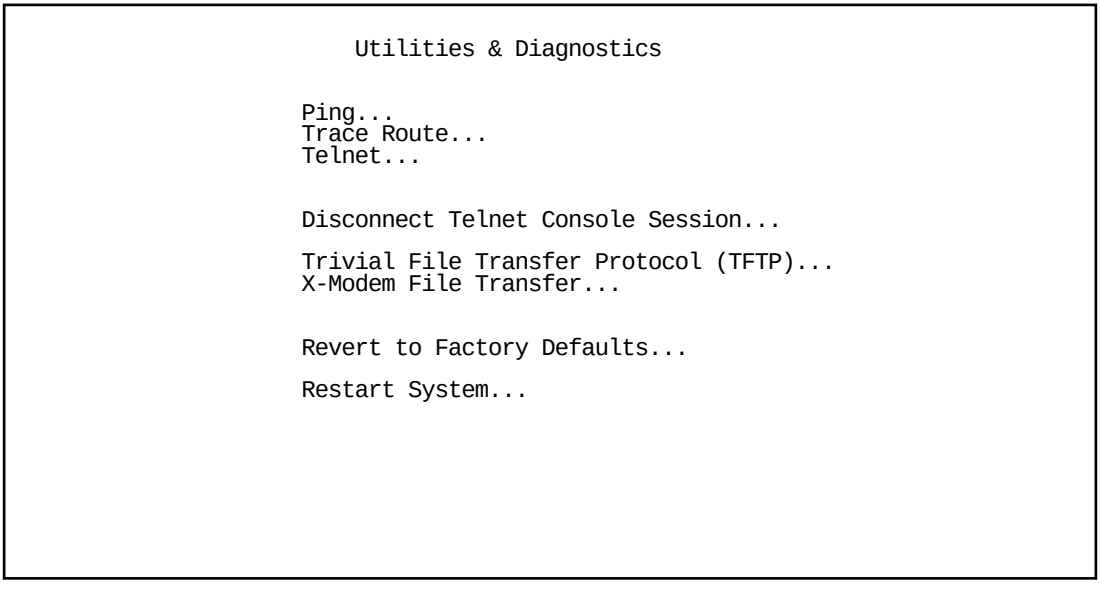
Utilities and Diagnostics

A number of utilities and tests are available for system diagnostic and control purposes.

This section covers the following topics:

Note: These utilities and tests are accessible only through the console-based management screens. See Chapter 6, "Console-Based Management," for information on accessing the console-based management screens.

You access the Utilities & Diagnostics screens from the Main Menu.

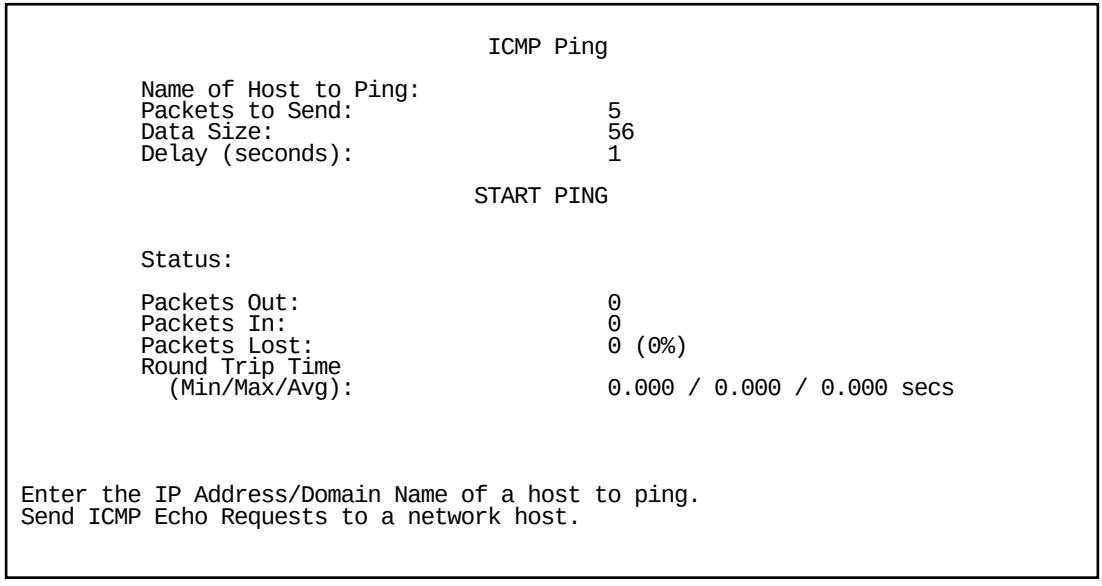


Ping

The Netopia R5000 Series Router includes a standard Ping test utility. A Ping test generates IP packets destined for a particular (Ping-capable) IP host. Each time the target host receives a Ping packet, it returns a packet to the original sender.

Ping allows you to see whether a particular IP destination is reachable from the Netopia R5000 Series Router. You can also ascertain the quality and reliability of the connection to the desired destination by studying the Ping test's statistics.

In the Utilities & Diagnostic screen, select **Ping** and press Return. The ICMP Ping screen appears.



To configure and initiate a Ping test, follow these steps:

1. Select **Name of Host to Ping** and enter the destination domain name or IP address.
2. Select **Packets to Send** to change the default setting. This is the total number of packets to be sent during the Ping test. The default setting is adequate in most cases, but you can change it to any value from 1 to 4,294,967,295.
3. Select **Data Size** to change the default setting. This is the size, in bytes, of each Ping packet sent. The default setting is adequate in most cases, but you can change it to any value from 0 (only header data) to 1664.
4. Select **Delay (seconds)** to change the default setting. The delay, in seconds, determines the time between Ping packets sent. The default setting is adequate in most cases, but you can change it to any value from 0 to 4,294,967. A delay of 0 seconds forces packets to be sent immediately, one after another.
5. Select **START PING** and press Return to begin the Ping test. While the test is running, the **START PING** item becomes **STOP PING**. To manually stop the Ping test, select **STOP PING** and press Return or Escape.

While the Ping test is running and when it is over, a status field and a number of statistical items are active on the screen. These are described below.

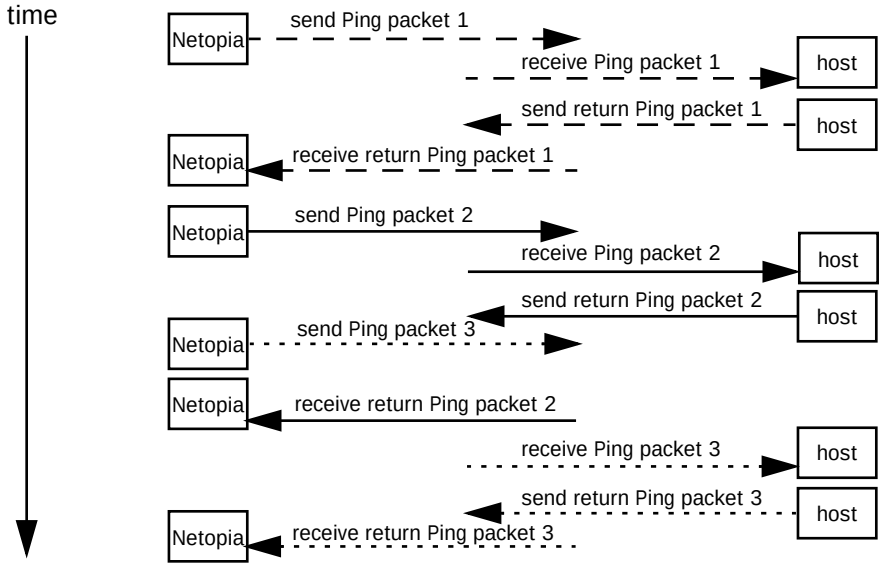
Status: The current status of the Ping test. This item can display the status messages shown in the able below:

Message	Description
Resolving host name	Finding the IP address for the domain name-style address
Can't resolve host name	IP address can't be found for the domain name–style name
Pinging	Ping test is in progress
Complete	Ping test was completed
Cancelled by user	Ping test was cancelled manually
Destination unreachable from w.x.y.z	Ping test was able to reach the router with IP address w.x.y.z, which reported that the test could not reach the final destination
Couldn't allocate packet buffer	Couldn't proceed with Ping test; try again or reset system
Couldn't open ICMP port	Couldn't proceed with Ping test; try again or reset system

Packets Out: The number of packets sent by the Ping test.

Packets In: The number of return packets received from the target host. To be considered on time, return packets are expected back before the next packet in the sequence of Ping packets is sent. A count of the number of late packets appears in parentheses to the right of the **Packets In** count.

In the example that follows, a Netopia R5000 Series Router is sending Ping packets to another host, which responds with return Ping packets. Note that the second return Ping packet is considered to be late because it is not received by the Netopia R5000 Series Router before the third Ping packet is sent. The first and third return Ping packets are on time.



Packets Lost: The number of packets unaccounted for, shown in total and as a percentage of total packets sent. This statistic may be updated during the Ping test, and may not be accurate until after the test is over. However, if an escalating one-to-one correspondence is seen between **Packets Out** and **Packets Lost**, and **Packets In** is noticeably lagging behind **Packets Out**, the destination is probably unreachable. In this case, use **STOP PING**.

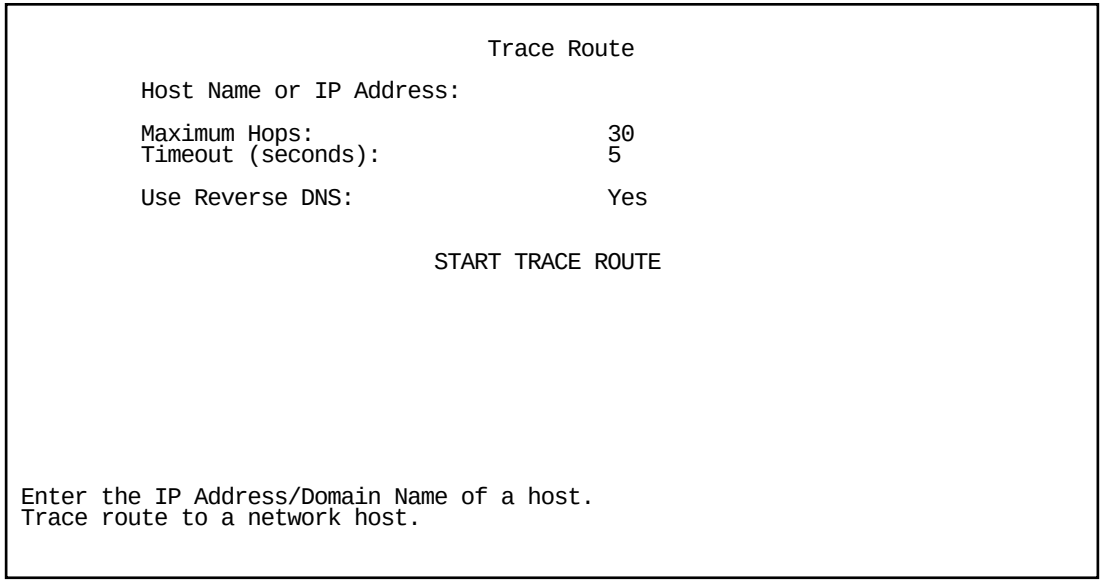
Round Trip Time (Min / Max / Avg): Statistics showing the minimum, maximum, and average number of seconds elapsing between the time each Ping packet was sent and the time its corresponding return Ping packet was received.

The time-to-live (TTL) value for each Ping packet sent by the Netopia R5000 Series Router is 255, the maximum allowed. The TTL value defines the number of IP routers that the packet can traverse. Ping packets that reach their TTL value are dropped, and a "destination unreachable" notification is returned to the sender (see the table on the previous page). This ensures that no infinite routing loops occur. The TTL value can be set and retrieved using the SNMP MIB-II ip group's ipDefaultTTL object.

Trace Route

You can count the number of routers between your Netopia Router and a given destination with the Trace Route utility.

In the Statistics & Diagnostics screen, select **Trace Route** and press Return. The Trace Route screen appears.



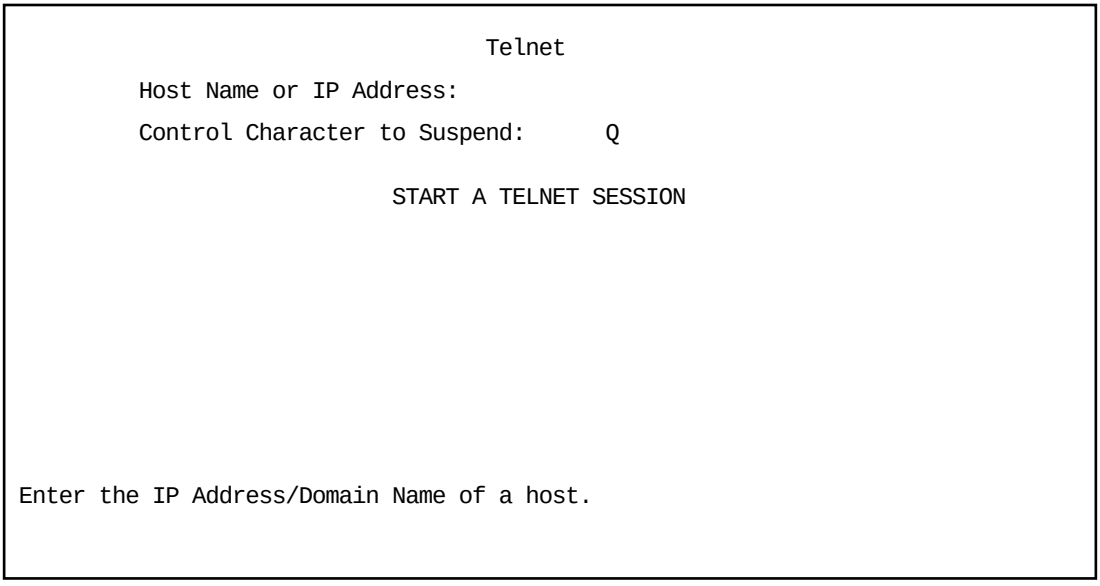
To trace a route, follow these steps:

1. Select **Host Name or IP Address** and enter the name or address of the destination you want to trace.
2. Select **Maximum Hops** to set the maximum number of routers to count between the Netopia Router and the destination router, up to the maximum of 64. The default is 30 hops.
3. Select **Timeout (seconds)** to set when the trace will timeout for each hop, up to 10 seconds. The default is 3 seconds.
4. Select **Use Reverse DNS** to learn the names of the routers between the Netopia Router and the destination router. The default is Yes.
5. Select **START TRACE ROUTE** and press Return. A scrolling screen will appear that lists the destination, number of hops, IP addresses of each hop, and DNS names, if selected.
6. Cancel the trace by pressing Escape. Return to the Trace Route screen by pressing Escape twice.

Telnet client

The Telnet client mode replaces the normal menu mode. Telnet sessions can be cascaded, that is, you can initiate a Telnet client session when using a Telnet console session. To activate the Telnet client, select **Telnet** from the Utilities & Diagnostics menu.

The Telnet client screen appears.



- Enter the host name or the IP address in dotted decimal format of the machine you want to Telnet into and press Return.
- Either accept the default control character "Q" used to suspend the Telnet session, or type a different one.
- **START A TELNET SESSION** becomes highlighted.
- Press Return and the Telnet session will be initiated.
- To suspend the session, press Control-Q or whatever other control character you specified.

  Two new options will appear in the Telnet screen (not shown):

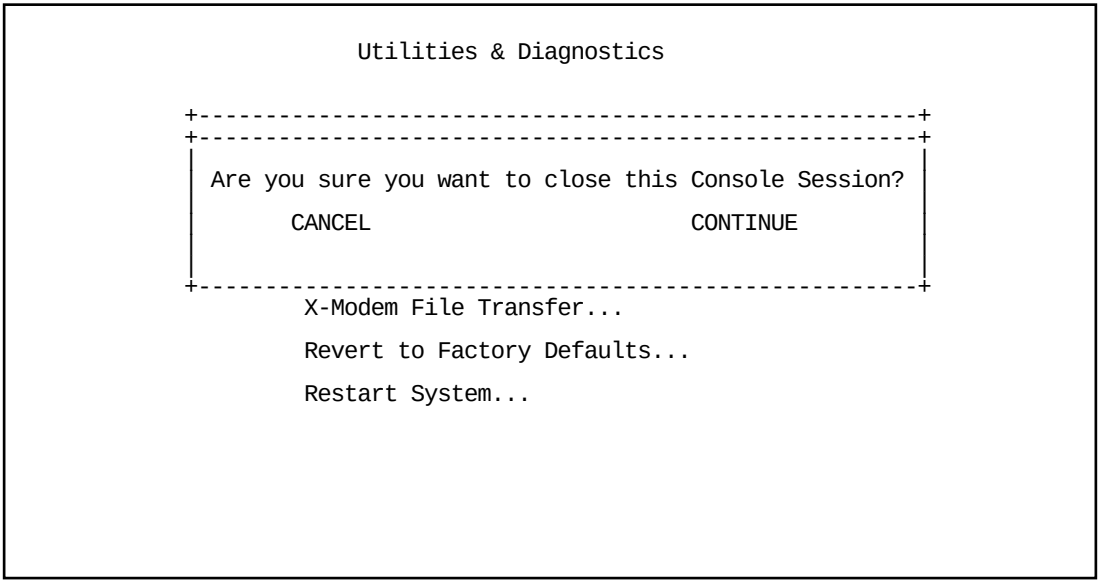
  Resume Suspended Session – select if you want to go back to your Telnet session

  Terminate Suspended Session – select if you want to end the session

Disconnect Telnet console session

If you want to close your Telnet console session, select **Disconnect Telnet Console Session** and press Return.

A dialog box appears asking you to cancel or continue your selection.



If you select **Continue**, you will immediately terminate your session.

Factory defaults

You can reset the Netopia R5000 Series Router to its factory default settings. In the Utilities & Diagnostics screen, select **Revert to Factory Defaults** and press Return. Select **CONTINUE** in the dialog box and press Return. The Netopia R5000 Series Router will reboot and its settings will return to the factory defaults, deleting your configurations.

In an emergency, you can also use the Reset switch to return the router to its factory default settings. Call Netopia Technical Support for instructions on using the Reset switch.

Note: Reset to factory defaults with caution. You will need to reconfigure all of your settings in the router.

If you lose your password and are unable to access the console screens, you can manually reset the router in an emergency. See Appendix A, “Troubleshooting.”

Transferring configuration and firmware files with TFTP

Trivial File Transfer Protocol (TFTP) is a method of transferring data over an IP network. TFTP is a client-server application, with the router as the client. To use the Netopia R5000 Series Router as a TFTP client, a TFTP server must be available. Netopia, Inc. has a public access TFTP server on the Internet where you can obtain the latest firmware versions.

To use TFTP, select **Trivial File Transfer Protocol (TFTP)** in the Statistics & Diagnostics screen and press Return. The Trivial File Transfer Protocol (TFTP) screen appears.

```
                Trivial File Transfer Protocol (TFTP)

        TFTP Server Name:


        Firmware File Name:

        GET ROUTER FIRMWARE FROM SERVER...
        GET WAN MODULE FIRMWARE FROM SERVER...


        Config File Name:

        GET CONFIG FROM SERVER...
        SEND CONFIG TO SERVER...


        TFTP Transfer State -- Idle

        TFTP Current Transfer Bytes -- 0
```

The sections below describe how to update the Netopia R5000 Series Router's firmware and how to download and upload configuration files.

Updating firmware

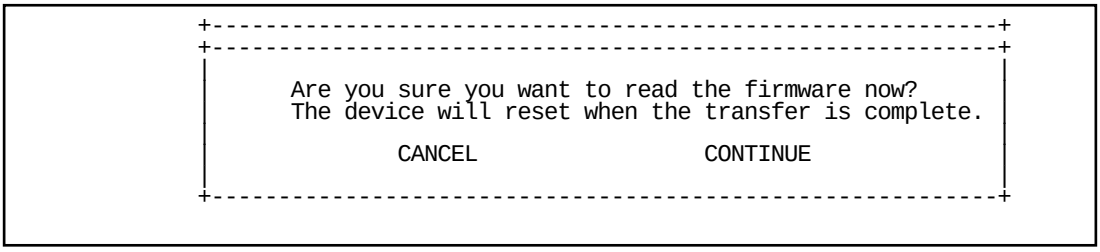
Firmware updates may be available periodically from Netopia or from a site maintained by your organization's network administrator.

There are two types of firmware in the Netopia R5000 Series Router Router: router firmware and WAN module firmware. The router firmware governs how the router communicates with your network and the WAN module; the WAN module firmware governs how the WAN module communicates with the remote site. WAN module firmware is included on your Netopia CD for XMODEM transfer and later updates will be available on the Netopia website. Router firmware updates are also periodically posted on the Netopia website.

To update either the router's or the internal WAN module's firmware, follow these steps:

- Select **TFTP Server Name** and enter the server name or IP address of the TFTP server you will use. The server name or IP address is available from the site where the server is located.
- Select **Firmware File Name** and enter the name of the file you will download. The name of the file is available from the site where the server is located. You may need to enter a file path along with the file name (for example, bigroot/config/myfile).

- Select **GET ROUTER FIRMWARE FROM SERVER** or **GET WAN MODULE FIRMWARE FROM SERVER** and press Return. You will see the following dialog box:



- Select **CANCEL** to exit without downloading the file, or select **CONTINUE** to download the file. The system will reset at the end of the file transfer to put the new firmware into effect. While the system resets, the LEDs will blink on and off.

Caution!

- Be sure the firmware update you load onto your router is the correct version for your particular model. Some models do not support all firmware versions. Loading an incorrect firmware version can permanently damage the unit.
- Do not manually power down or reset the Netopia R5000 Series Router while it is automatically resetting or it could be damaged.
- If you choose to download the firmware, the **TFTP Transfer State** item will change from **Idle** to **Reading Firmware**. The **TFTP Current Transfer Bytes** item will reflect the number of bytes transferred.

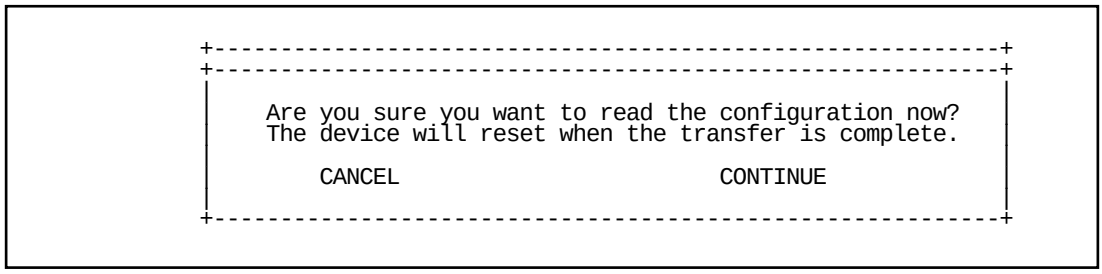
Downloading configuration files

The Netopia R5000 Series Router can be configured by downloading a configuration file using TFTP. Once downloaded, the file reconfigures all of the router's parameters as if someone had manually done so through the console port.

To download a configuration file, follow these steps:

- Select **TFTP Server Name** and enter the server name or IP address of the TFTP server you will use. The server name or IP address is available from the site where the server is located.
- Select **Config File Name** and enter the name of the file you will download. The name of the file is available from the site where the server is located. You may need to enter a file path along with the file name (for example, bigroot/config/myfile).

- Select **GET CONFIG FROM SERVER** and press Return. You will see the following dialog box:



- Select **CANCEL** to exit without downloading the file, or select **CONTINUE** to download the file. The system will reset at the end of the file transfer to put the new configuration into effect.
- If you choose to download the configuration file, the **TFTP Transfer State** item will change from **Idle** to **Reading Config**. The **TFTP Current Transfer Bytes** item will reflect the number of bytes transferred.

Uploading configuration files

Using TFTP, you can send a file containing a snapshot of the router's current configuration to a TFTP server. The file can then be downloaded by a different Netopia R5000 Series Router unit to configure its parameters (see "Downloading configuration files" on page 14-9). This is useful for configuring a number of routers with identical parameters, or just for creating configuration backup files.

Uploading a file can also be useful for troubleshooting purposes. The uploaded configuration file can be tested on a different Netopia R5000 Series Router unit by Netopia or your network administrator.

To upload a configuration file, follow these steps:

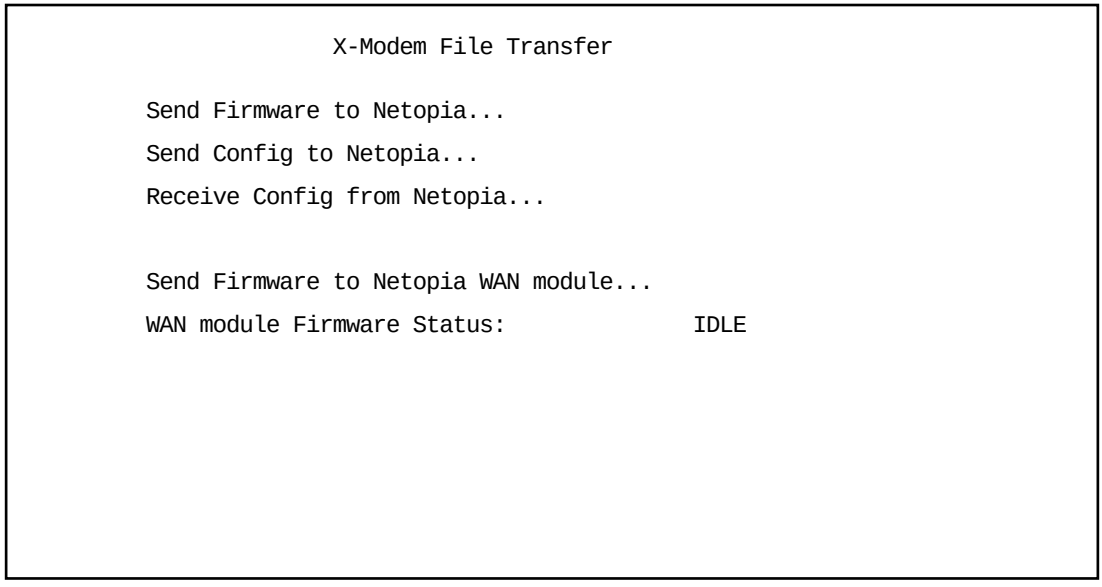
1. Select **TFTP Server Name** and enter the server name or IP address of the TFTP server you will use. The server name or IP address is available from the site where the server is located.
2. Select **Config File Name** and enter a name for the file you will upload. The file will appear with the name you choose on the TFTP server. You may need to enter a file path along with the file name (for example, Mypc/Netopia/myfile).
3. Select **SEND CONFIG TO SERVER** and press Return. Netopia will begin to transfer the file.
4. The **TFTP Transfer State** item will change from **Idle** to **Writing Config**. The **TFTP Current Transfer Bytes** item will reflect the number of bytes transferred.

Transferring configuration and firmware files with XMODEM

You can transfer configuration and firmware files with XMODEM through the Netopia R5000 Series Router's console port. Be sure your terminal emulation program supports XMODEM file transfers.

To go to the **X-Modem File Transfer** screen, select it in the Utilities & Diagnostics menu.

Note: The X-Modem File Transfer screen is only available if you are connected via the Console port.

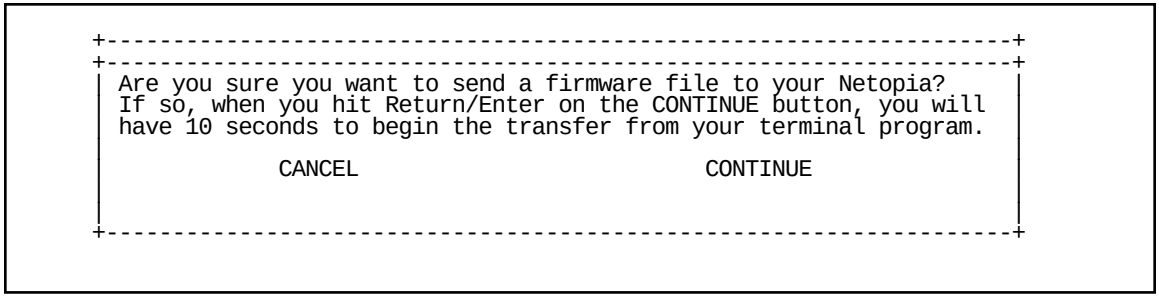


Updating firmware

Firmware updates may be available periodically from Netopia or from a site maintained by your organization's network administration. The procedure below applies whether you are using the console or the WAN interface module.

Follow these steps to update the Netopia R5000 Series Router's firmware:

1. Make sure you have the firmware file on disk and know the path to its location.
2. Select **Send Firmware to Netopia** (or **Send Firmware to Netopia WAN module**) and press Return. The following dialog box appears:



3. Select **CANCEL** to exit without downloading the file, or select **CONTINUE** to download the file.

   If you choose CONTINUE, you will have ten seconds to use your terminal emulation software to initiate an XMODEM transfer of the firmware file. If you fail to initiate the transfer in that time, the dialog box will disappear and the terminal emulation software will inform you of the transfer's failure. You can then try again.

The system will reset at the end of a successful file transfer to put the new firmware into effect. While the system resets, the LEDs will blink on and off.

Caution!

Do not manually power down or reset the Netopia R5000 Series Router while it is automatically resetting or it could be damaged.

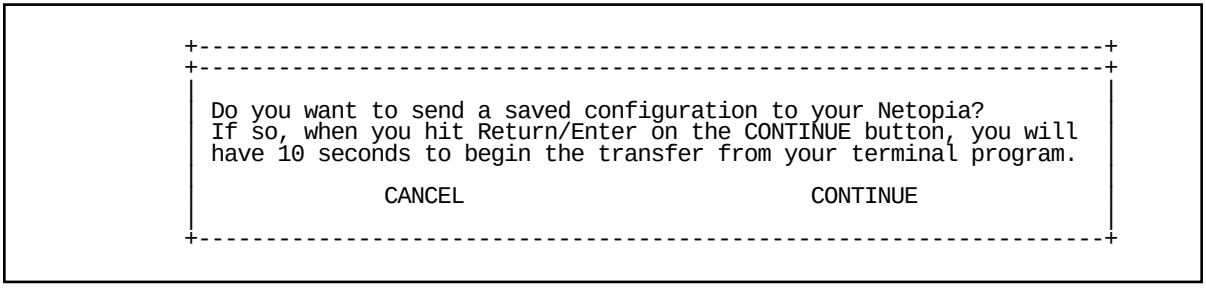
Downloading configuration files

The Netopia R5000 Series Router can be configured by downloading a configuration file. The downloaded file reconfigures all of the Router's parameters.

Configuration files are available from a site maintained by your organization's network administrator or from your local site (see "Uploading configuration files," below).

Follow these steps to download a configuration file:

1. Make sure you have the configuration file on disk and know the path to its location.
2. Select **Send Config to Netopia** and press Return. The following dialog box appears:



3. Select **CANCEL** to exit without downloading the file, or select **CONTINUE** to download the file.

   If you choose CONTINUE, you will have ten seconds to use your terminal emulation software to initiate an XMODEM transfer of the configuration file. If you fail to initiate the transfer in that time, the dialog box will disappear and the terminal emulation software will inform you of the transfer's failure. You can then try again.

   The system will reset at the end of a successful file transfer to put the new configuration into effect.

Uploading configuration files

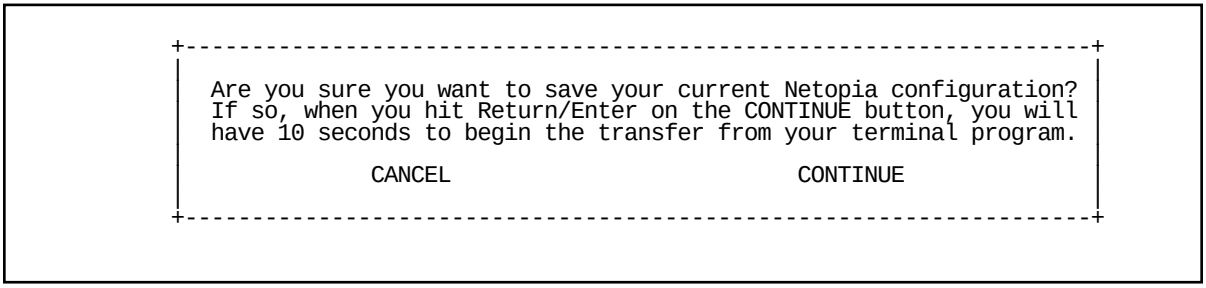
A file containing a snapshot of the Netopia R5000 Series Router's current configuration can be uploaded from the router to disk. The file can then be downloaded by a different Netopia R5000 Series Router to configure its parameters (see "Downloading configuration files," above). This is useful for configuring a number of routers with identical parameters or for creating configuration backup files.

Uploading a file can also be useful for troubleshooting purposes. The uploaded configuration file can be tested on a different Netopia R5000 Series Router by Netopia or your network administrator.

The procedure below applies whether you are using the console or the WAN interface. To upload a configuration file:

1. Decide on a name for the file and a path for saving it.

2. Select **Receive Config from Netopia** and press Return. The following dialog box appears:



3. Select **CANCEL** to exit without uploading the file, or select **CONTINUE** to upload the file.

   If you choose CONTINUE, you will have ten seconds to use your terminal emulation software to initiate an XMODEM transfer of the configuration file. If you fail to initiate the transfer in that time, the dialog box will disappear and the terminal emulation software will inform you of the transfer's failure. You can then try again.

Restarting the system

You can restart the system by selecting the **Restart System** item in the Utilities & Diagnostics screen.

You must restart the system whenever you reconfigure the Netopia R5000 Series Router and want the new parameter values to take effect. Under certain circumstances, restarting the system may also clear up system or network malfunctions. Some configuration processes automatically restart the system to apply the changes you have made.

Part III: Appendixes

Appendix A

Troubleshooting

This appendix is intended to help you troubleshoot problems you may encounter while setting up and using the Netopia R5000 Series Router. It also includes information on how to contact Netopia Technical Support.

Important information on these problems can be found in the event histories kept by the Netopia R5000 Series Router. These event histories can be accessed in the Statistics & Logs screen.

This section covers the following topics:

Configuration problems

If you encounter problems during your initial configuration process, review the following suggestions before calling for technical support. There are four zones to consider when troubleshooting initial configuration:

1. The computer's connection to the router
2. The router's connection to the telecommunication line(s)
3. The telecommunication line's connection to your ISP
4. The ISP's connection to the Internet

If the connection from the computer to the router was not successful, verify that the following conditions are in effect:

- The Netopia R5000 Series Router is turned on.
- An Ethernet cable connects your PC's Ethernet card or built-in Ethernet port to the Netopia R5000 Series Router.
- The SmartStart application is running and able to access the Netopia R5000 Series Router.
- Telnet is available on your PC or Macintosh. (On a PC, it must be specified in your system path. You can usually find the application as "c:\windows\telnet.exe".)
- Your PC or Macintosh is properly configured for TCP/IP.
- Your PC or Macintosh has an IP address.
- Your PC or Macintosh has a subnet mask that matches or is compatible with the Netopia R5000 Series Router's subnet mask.

Note: If you are attempting to modify the IP address or subnet mask from a previous, successful configuration attempt, you will need to clear the IP address or reset your Netopia R5000 Series Router to the factory default before reinitiating the configuration process. For further information on resetting your Netopia R5000 Series Router to factory default, see "Factory defaults" on page 14-7.

Console connection problems

Can't see the configuration screens (nothing appears)

- Make sure the cable connection from the Netopia R5000 Series Router's console port to the computer being used as a console is securely connected.
- Make sure the terminal emulation software is accessing the correct port on the computer that's being used as a console.
- Try pressing Ctrl-L or Return or the up arrow or down arrow key several times to refresh the terminal screen.
- Make sure that flow control on serial connections is turned off.

Junk characters appear on the screen

- Check that the terminal emulation software is configured correctly.
- Check the baud rate. The default values are 9600, N, 8, and 1.

Characters are missing from some of the configuration screens

- Try changing the Netopia R5000 Series Router's default speed of 9600 bps and setting your terminal emulation software to match the new speed.

Network problems

Problems communicating with remote IP hosts

- Verify the accuracy of the default gateway's IP address (entered in the IP Setup or Easy Setup screen).
- Use the Netopia R5000 Series Router's Ping utility, in the Utilities & Diagnostics screen, and try to Ping local and remote hosts. See "Ping" on page 14-2 for instructions on how to use the Ping utility. If you can successfully ping hosts using their IP addresses but not their domain names (198.34.7.1 but not garcia.netopia.com, for example), verify that the DNS server's IP address is correct and that it is reachable from the Netopia R5000 Series Router (use Ping).
- If you are using filters, check that your filter sets are not blocking the type of connections you are trying to make.

Local routing problems

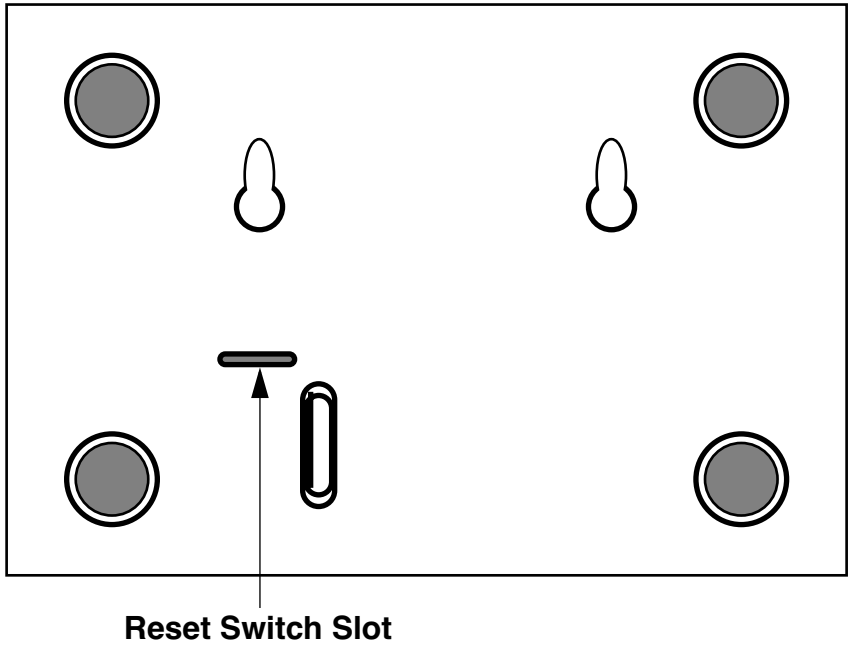
- Observe the Ethernet LEDs to see if data traffic flow appears to be normal.
- Check the WAN statistics and LAN statistics screens to see more specific information on data traffic flow and address serving. See "Statistics & Logs" on page 12-4 for more information.

How to reset the router to factory defaults

This section shows how to reset the router so that you can access the console screens once again, even if you lose your password. Keep in mind that all of your connection profiles and settings will need to be reconfigured.

If you don't have a password, the only way to get back into the Netopia R5000 Series Router is the following:

1. Turn the router upside down.
2. Referring to the diagram below, find the paper clip-size Reset Switch slot.



3. Carefully insert the larger end of a standard size paper clip until you contact the internal Reset Switch. (No need to unwind the paper clip.)
4. Press this switch.
5. This will reset the unit to factory defaults and you will now be able to reprogram the router.

Power outages

If you suspect that power was restored after a power outage and the Netopia R5000 Series Router is connected to a remote site, you may need to switch the Netopia R5000 Series Router off and then back on again. After temporary power outages, a connection that still seems to be up may actually be disconnected. Rebooting the router should reestablish the connection.

Technical support

Netopia, Inc. is committed to providing its customers with reliable products and documentation, backed by excellent technical support.

Before contacting Netopia

Look in this guide for a solution to your problem. You may find a solution in this troubleshooting appendix or in other sections. Check the index for a reference to the topic of concern. If you cannot find a solution, complete the environment profile below before contacting Netopia Technical Support.

Environment profile

- Locate the Netopia R5000 Series Router's model number, product serial number, and firmware version. The serial number is on the bottom of the router, along with the model number. The firmware version appears in the Netopia R5000 Series Router's Main Menu screen.

  Model number:

  Serial number:

  Firmware version:

- What kind of local network(s) do you have, with how many devices?

  Ethernet

  LocalTalk

  EtherTalk

  TCP/IP

  IPX

  Other

How to reach us

We can help you with your problem more effectively if you have completed the environment profile in the previous section. If you contact us by telephone, please be ready to supply Netopia Technical Support with the information you used to configure the Netopia R5000 Series Router. Also, please be at the site of the problem and prepared to reproduce it and to try some troubleshooting steps.

When you are prepared, contact Netopia Technical Support by e-mail, telephone, fax, or post:

Internet: techsports@netopia.com (for technical support)
info@netopia.com (for general information)

Phone: 1 800-782-6449
Fax: 1 510-814-5023

Netopia, Inc.
Customer Service
2470 Mariner Square Loop
Alameda, California 94501
USA

Netopia Bulletin Board Service: 1 510-865-1321

Online product information

Product information can be found in the following:

Netopia World Wide Web server via http://www.netopia.com
Internet via anonymous FTP to ftp.netopia.com/pub

FAX-Back

This service provides technical notes that answer the most commonly asked questions and offers solutions for many common problems encountered with Netopia products.

FAX-Back: 1 510-814-5040

Appendix B

Understanding IP Addressing

This appendix is a brief general introduction to IP addressing. A basic understanding of IP will help you in configuring the Netopia R5000 Series Router and using some of its powerful features, such as static routes and packet filtering.

This section covers the following topics:

What is IP?

All networks use protocols to establish common standards for communication. One widely used network protocol is the Internet Protocol, also known as IP. Like many other protocols, IP uses packets, or formatted chunks of data, to communicate.

In packets, a header is part of the envelope information that surrounds the actual data being transmitted. In e-mail, a header is usually the address and routing information found at the top of messages.

Note: This guide uses the term "IP" in a very general and inclusive way to identify all of the following:

- Networks that use the Internet Protocol, along with accompanying protocols such as TCP, UDP, and ICMP
- Packets that include an IP header within their structure
- Devices that send IP packets

About IP addressing

Every networking protocol uses some form of addressing in order to ensure that packets are delivered correctly. In IP, individual network devices that are initial sources and final destinations of packets are usually called hosts instead of nodes, but the two terms are interchangeable. Each host on an IP network must have a unique IP address. An IP address, also called an Internet address, is a 32-bit number usually expressed as four decimal numbers separated by periods. Each decimal number in an IP address represents a 1-byte (8-bit) binary number. Thus, values for each of the four numbers range from 00000000 to 11111111 in binary notation, or from 0 to 255 in decimal notation. The expression 192.168.1.1 is a typical example of an IP address.

IP addresses indicate both the identity of the network and the identity of the individual host on the network. The number of bits used for the network number and the number of bits used for the host number can vary, as long as certain rules are followed. The local network manager assigns IP host numbers to individual machines.

IP addresses are maintained and assigned by the InterNIC, a quasi-governmental organization now increasingly under the auspices of private industry.

Note: It's very common for an organization to obtain an IP address from a third party, usually an Internet service provider (ISP). ISPs usually issue an IP address when they are contracted to provide Internet access services.

The InterNIC (the NIC stands for Network Information Center) divides IP addresses into several classes. Classes A, B, and C are assigned to organizations that request addresses. In Class A networks, the first byte of an IP address is reserved for the network portion of the address. Class B networks reserve the first two bytes of an IP address for the network address. Class C networks reserve the first three bytes of an IP address for the network address. In all cases, a network manager can decide to use subnetting to assign even more bits to the network portion of the IP address, but never less than the class requires. The following section gives more information on subnetting.

Class A networks have a small number of possible network numbers, but a large number of possible host numbers. Conversely, Class C networks have a small number of possible host numbers, but a large number of possible network numbers. Thus, the InterNIC assigns Class A addresses to large organizations that have very large numbers of IP hosts, while smaller organizations, with fewer hosts, get Class B or Class C addresses. You can tell the various classes apart by the value of the first (or high-order) byte. Class A networks use values from 1 to 127, Class B networks use values from 128 to 191, and Class C networks use values from 192 to 223. The following table summarizes some of the differences between Class A, B, and C networks.

Class	First byte	Number of networks possible per class	Number of hosts possible per network	Format of address (without subnetting)	Example
A	1–127	127	16,777,214	net.host.host.host	97.3.14.250
B	128–191	16,384	65,534	net.net.host.host	140.100.10.11
C	192–223	2,097,152	254	net.net.net.host	197.204.13.7

Subnets and subnet masks

Often an entire organization is assigned only one IP network number. If the organization has several IP networks connected together with IP routers, the network manager can use subnetting to distinguish between these networks, even though they all use the same network number. Each physical network becomes a subnet with a unique subnet number.

Subnet numbers appear within IP addresses, along with network numbers and host numbers. Since an IP address is always 32 bits long, using subnet numbers means either the network number or the host numbers must use fewer bits in order to leave room for the subnet numbers. Since the InterNIC assigns the network number proper, it should not change, so the subnet numbers must be created out of bits that would otherwise be part of the host numbers.

Subnet masks

To create subnets, the network manager must define a subnet mask, a 32-bit number that indicates which bits in an IP address are used for network and subnetwork addresses and which are used for host addresses. One subnet mask should apply to all IP networks that are physically connected together and share a single assigned network number. Subnet masks are often written in decimal notation like IP addresses, but they are most easily understood in binary notation. When a subnet mask is written in binary notation, each numeral 1 indicates that the corresponding bit in the IP address is part of the network or subnet address. Each 0 indicates that the corresponding bit is part of the host address. The following table shows the proper subnet masks to use for each class of network when no subnets are required.

Class	Subnet mask for a network with no subnets
A	Binary: 11111111.00000000.00000000.00000000 Decimal: 255.0.0.0
B	Binary: 11111111.11111111.00000000.00000000 Decimal: 255.255.0.0
C	Binary: 11111111.11111111.11111111.00000000 Decimal: 255.255.255.0

To know whether subnets are being used or not, you must know what subnet mask is being used—you cannot determine this information simply from an IP address. Subnet mask information is configured as part of the process of setting up IP routers and gateways such as the Netopia R5000 Series Router.

Note: If you receive a routed account from an ISP, there must be a mask associated with your network IP address. By using the IP address with the mask you can discover exactly how many IP host addresses you actually have.

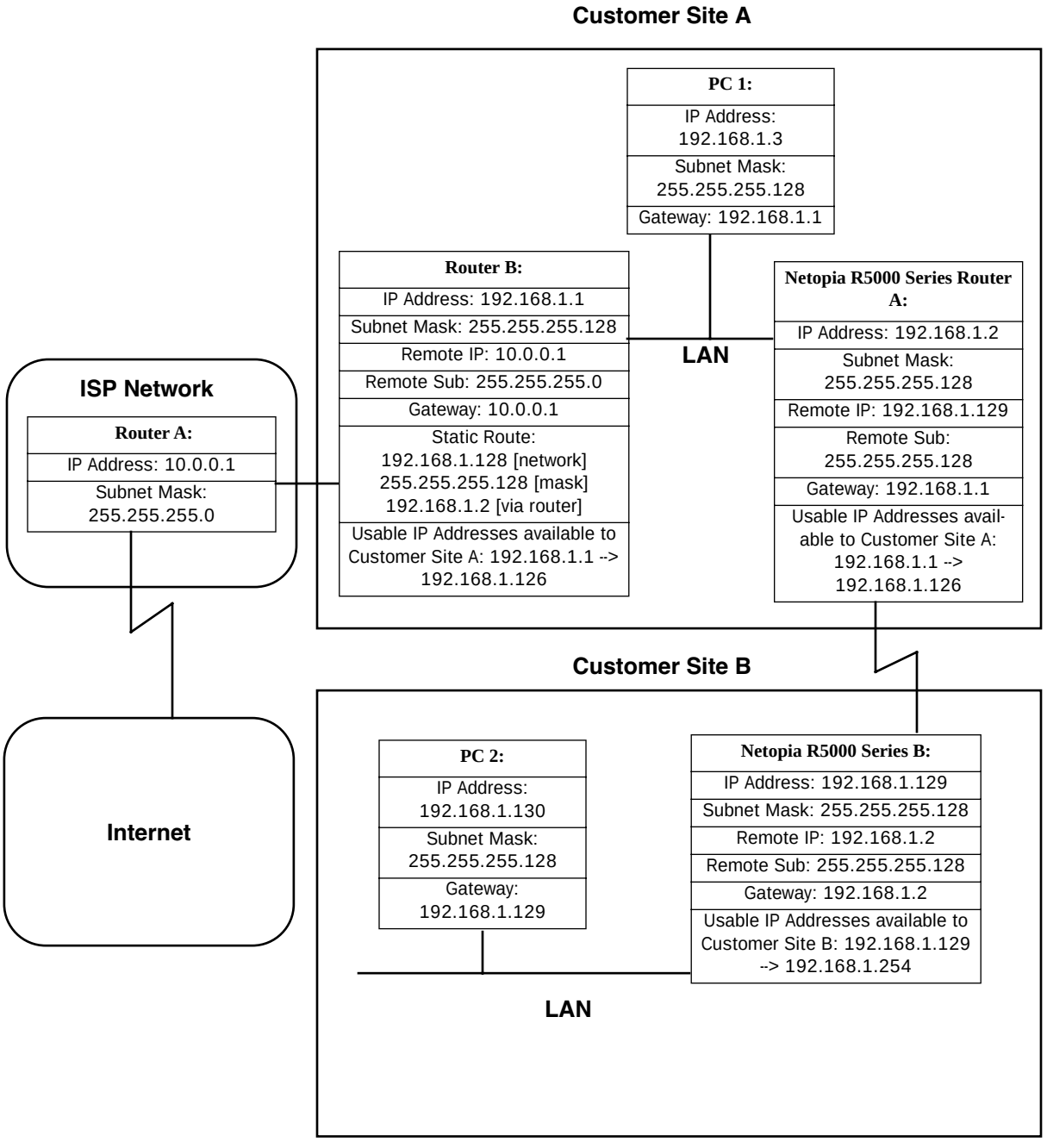
To configure subnets properly, you must also be able to convert between binary notation and decimal notation.

Example: Using subnets on a Class C IP internet

When setting up IP routing with a Class A address, or even with multiple Class C addresses, subnetting is fairly straightforward. Subnetting a single Class C address between two networks, however, is more complex. This section describes the general procedures for subnetting a single Class C network between two Netopia routers so that each can have Internet access.

Network configuration

Below is a diagram of a simple network configuration. The ISP is providing a Class C address to the customer site, and both networks A and B want to gain Internet access through this address. Netopia R5000 Series Router B connects to Netopia R5000 Series Router A and is provided Internet access through Routers A and B.



Background

The IP addresses and routing configurations for the devices shown in the diagram are outlined below. In addition, each individual field and its meaning are described.

The IP Address and Subnet Mask fields define the IP address and subnet mask of the device's Ethernet connection to the network while the Remote IP and Remote Sub fields describe the IP address and subnet mask of the remote router. This information is entered in the connection profile of the Netopia R5000 Series Router.

The Gateway field describes the router or workstation's default gateway, or where they will send their packets if the appropriate route is not known. The Static Route field, which is only shown on Router B, tells Router B what path to take to get to the network defined by Netopia R5000 Series Router B. Finally, the Usable IP Address field shows the range of IP addresses available to the hosts of that network.

Note that the IP addresses given in this section are for example purposes only. Do not use these addresses when configuring your network.

With this configuration, both Customer Site A and B can gain Internet access through Routers A and B, with no reconfiguration of the ISP's equipment. The most important item in this configuration is the static route defined on Router B. This tells Router B what path to take to get to the network defined by Netopia R5000 Series Router B. Without this information, Customer Site B will be able to access Customer Site A, but not the Internet.

If it is not possible to define a static route on Router B, RIP could be enabled to serve the same purpose. To use RIP instead of a static route, enable Transmit RIP on Netopia R5000 Series Router A and Transmit and Receive RIP on Router B. This will allow the route from Customer Site B to propagate on Router B and Customer Site A.

Example: Working with a Class C subnet

Suppose that your organization has a site with only 10 hosts and no plans to add any new hosts. You don’t need a full Class C address for this site. Many ISPs offer Internet access with only a portion of a full Internet address.

For example, you might obtain the Class C address 199.14.17.48, with the mask 255.255.255.240. From the previous example, you can see that this gives you 14 host addresses to distribute to the hosts at your site. In effect, your existing network of 10 hosts is a subnet of the ISP’s network. Since the Class C address has already been reduced to subnets, you cannot further subnet your network without the risk of creating network routing problems (since you must use the mask issued by the ISP). This, however, is not a problematic limitation for your small network.

The advantages of this situation are the greater ease and lower cost of obtaining a subnet rather than a full Class C address from an ISP.

Distributing IP addresses

To set up a connection to the Internet, you may have obtained a block of IP host addresses from an ISP. When configuring the Netopia R5000 Series Router, you gave one of those addresses to its Ethernet port, leaving a number of addresses to distribute to computers on your network.

There are two schemes for distributing the remaining IP addresses:

- Manually give each computer an address
- Let the Netopia R5000 Series Router automatically distribute the addresses

These two methods are not mutually exclusive; you can manually issue some of the addresses while the rest are distributed by the Netopia R5000 Series Router. Using the router in this way allows it to function as an address server.

One reason to use the Netopia R5000 Series Router as an address server is that it takes less time than manually distributing the addresses. This is particularly true if you have many addresses to distribute. You need only enter information once, rather than having to enter it on each host separately. This also reduces the potential for misconfiguring hosts.

Another reason to use the Netopia R5000 Series Router as an address server is that it will distribute addresses only to hosts that need to use them.

All Netopia R5000 Series Routers come with an integrated Dynamic Host Control Protocol (DHCP) server. Some routers also come with a Macintosh Internet Protocol (MacIP) server. These servers provide a means of distributing IP addresses to either a Mac or PC workstation as needed.

When setting up the DHCP or MacIP servers in the Netopia R5000 Series Router, it is necessary to understand how workstations lease, renew, and release their IP addresses. This information is helpful in determining dynamic address allocation for a network.

The term "lease" describes the action of a workstation requesting and using an IP address. The address is dynamic and can be returned to the address pool at a later time.

The term "renew" refers to what the workstations do to keep their leased IP address. At certain intervals, the workstation talks to the DHCP or MacIP server and renews the lease on that IP address. This renewal allows the workstation to keep and use the assigned IP address until the next renewal period.

The term "release" refers to a situation where the workstation is no longer using its assigned IP address or has been shut down. IP addresses can be manually released as well. The IP address goes back into the DHCP or MacIP address pool to be reassigned to another workstation as needed.

Technical note on subnet masking

Note: The IP address supplied by the Netopia R5000 Series Router will be a unique number. You may want to replace this number with a number that your ISP supplies if you are configuring the router for a static IP address. The automatic IP mask supplied by SmartStart is a Class C address. However, the Netopia R5000 Series Router and all devices on the same local network must have the same subnet mask. If you require a different class address, you can edit the IP Mask field to enter the correct address. Refer to the table below.

Number of Devices (other than Netopia R5000 Series Router) on Local Network	Largest Possible Ethernet Subnet Mask
1	255.255.255.252
2-5	255.255.255.248
6-13	255.255.255.240

Number of Devices (other than Netopia R5000 Series Router) on Local Network	Largest Possible Ethernet Subnet Mask
14-29	255.255.255.224
30-61	255.255.255.192
62-125	255.255.255.128
125-259	255.255.255.0

Configuration

This section describes the specific IP address lease, renew, and release mechanisms for both the Mac and PC, with either DHCP or MacIP address serving.

DHCP address serving

Windows 95 workstation:

- The Win95 workstation requests and renews its lease every half hour.
- The Win95 workstation does NOT relinquish its DHCP address lease when the machine is shut down.
- The lease can be manually expired using the WINIPCFG program, a command line program executable from the DOS prompt or from the START:RUN menu, on a Windows 95 or 98 machine.

Windows 3.1 workstation (MSTCP Version 3.11a):

- The Win3.1 workstation requests and renews its lease every half hour.
- The Win3.1 workstation does NOT relinquish its DHCP address lease when the user exits Windows and goes to DOS.
- The lease can be manually expired by typing IPCONFIG/RELEASE from a DOS window within Windows or from the DOS prompt.

Macintosh workstation (Open Transport Version 1.1 or later):

- The Mac workstation requests and renews its lease every half hour.
- The Mac workstation relinquishes its address upon shutdown in all but one case. If the TCP/IP control panel is set to initialize at startup, and no IP services are used or the TCP/IP control panel is not opened, the DHCP address will NOT be relinquished upon shutdown. However, if the TCP/IP control panel is opened or if an IP application is used, the Mac WILL relinquish the lease upon shutdown.
- If the TCP/IP control panel is set to acquire an address only when needed (therefore a TCP/IP application must have been launched to obtain a lease) the Mac WILL relinquish its lease upon shutdown every time.

Netopia R5000 Series Router DHCP server characteristics

- The Netopia R5000 Series Router ignores any lease-time associated with a DHCP request and automatically issues the DHCP address lease for one hour.
- The number of devices a Netopia R5000 Series Router can serve DHCP to is 512. This is imposed by

global limits on the size of the address serving database, which is shared by all address serving functions active in the router.

- The Netopia R5000 Series Router releases the DHCP address back to the available DHCP address pool exactly one hour after the last-heard lease request. Some other DHCP implementations may retain the lease for an additional time after the lease expired. This is intended to act as a buffer for variances in clocks between the client and server.

MacIP serving

Macintosh workstation (MacTCP or Open Transport):

Once the Mac workstation requests and receives a valid address, the Netopia R5000 Series Router actively checks for the workstation's existence once every minute.

- For a dynamic address, the Netopia R5000 Series Router releases the address back to the address pool after it has lost contact with the Mac workstation for over 2 minutes.
- For a static address, the Netopia R5000 Series Router releases the address back to the address pool after it has lost contact with the Mac workstation for over 20 minutes.

Netopia R5000 Series Router MacIP server characteristics

The Mac workstation uses ATP to both request and receive an address from the Netopia R5000 Series Router's MacIP server. Once acquired, Name Binding Protocol (NBP) confirm packets will be sent out every minute from the Netopia R5000 Series Router to the Mac workstation.

Manually distributing IP addresses

If you choose to manually distribute IP addresses, you must enter each computer's address into its TCP/IP stack software. Once you manually issue an address to a computer, it possesses that address until you manually remove it. That's why manually distributed addresses are sometimes called static addresses.

Static addresses are useful in cases when you want to make sure that a host on your network cannot have its address taken away by the address server. Appropriate candidates for a static address include: a network administrator's computer, a computer dedicated to communicating with the Internet, and routers.

Using address serving

The Netopia R5000 Series Router provides three ways to serve IP addresses to computers on a network. The first, Dynamic Host Configuration Protocol (DHCP), is supported by PCs with Microsoft Windows and a TCP/IP stack. Macintosh computers using Open Transport and computers using the UNIX operating system may also be able to use DHCP. The second way, MacIP, is for Macintosh computers. The third way, called Serve Dynamic WAN Clients (IPCP), is used to fulfill WAN client requirements

The Netopia R5000 Series Router can use both DHCP and MacIP. Whether you use one or both depends on your particular networking environment. If that environment includes both PCs and Macintosh computers that do not use Open Transport, you need to use both DHCP and MacIP to distribute IP addresses to all of your computers.

Serve dynamic WAN clients

The correct term or protocol is a subset of the PPP suite call IPCP. Originally, this would apply only to switched WAN interface routers, and not to leased line routers. However, a new feature can give you Asynchronous PPP dial-in support on the Auxiliary port on any router including Netopia R5000 Series Routers.

In any situation where a device is dialing into a Netopia router, the router may need to be configured to serve IP via the WAN interface. This is only a requirement if the calling device has not been configured locally to know what its address(es) are. So when a client, dialing into a Netopia router's WAN interface, is expecting addresses to be served by the answering router, you must set the answering Netopia router to serve IP via its WAN interface.

You can do this in either of two ways:

- use the Serve Dynamic WAN Clients option in the Address Serving Setup screen.

  Enabling Serve Dynamic WAN Clients only allows you to specify a pool of addresses from which the dial-in client may get an IP address. It does not allow static addressing.

  If you want to serve addresses dynamically, use Serve Dynamic WAN Clients.

- define the address that you want to serve in the Connection Profile's IP Setup screen.

  This method requires a static value to be used. Thus any user dialing in can obtain the same IP address for every connection to the profile.

  If you want to serve addresses statically, define the address in the Connection Profile.

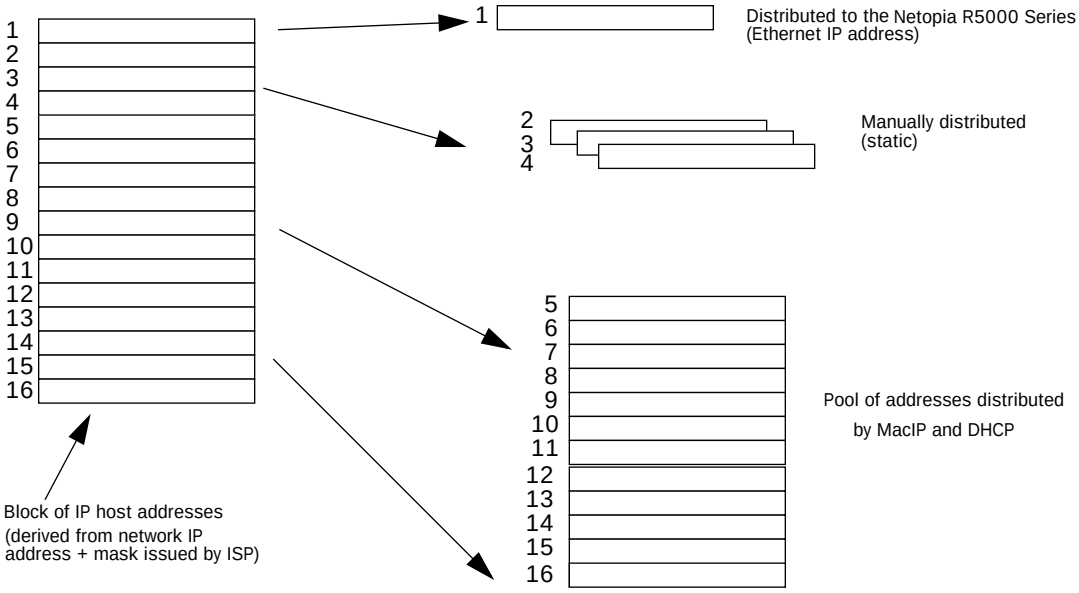
  Notes:

  - The addresses that are to be served cannot be used elsewhere. For example you wouldn't want to define a static address in a Connection Profile to be served via the WAN that is already defined in the DHCP pool of addresses.
  - In order to work correctly, you must define a host or node address in the IP Profile Parameters of the Connection Profile.

    This is accomplished by specifying the IP address that is to be statically served via the WAN, and then by entering a mask value of 255.255.255.255.

Tips and rules for distributing IP addresses

- Before you allocate IP addresses using DHCP and MacIP, consider whether you need to set aside any static addresses.
- Note any planned and currently used static addresses before you use DHCP and MacIP.
- Avoid fragmenting your block of IP addresses. For example, try to use a continuous range for the static addresses you choose.



The figure above shows an example of a block of IP addresses being distributed correctly.

The example follows these rules:

- An IP address must not be used as a static address if it is also in a range of addresses being distributed by DHCP or MacIP.
- A single IP address range is used by all the address-served clients. These include DHCP, BootP, MacIP, and WAN clients, even though BootP and static MacIP clients might not be considered served.
- The address range specified for address-served clients cannot wrap around from the end of the total available range back to the beginning. See below for a further explanation and an example.
- The network address issued by an ISP cannot be used as a host address.

A DHCP example

Suppose, for example, that your ISP gave your network the IP address 199.1.1.32 and a 4-bit subnet mask. Address 199.1.1.32 is reserved as the network address. Address 199.1.1.47 is reserved as the broadcast address. This leaves 14 addresses to allocate, from 199.1.1.33 through 199.1.1.46. If you want to allocate a sub-block of 10 addresses using DHCP, enter "10" in the DHCP Setup screen's **Number of Addresses to Allocate** item. Then, in the same screen's **First Address** item, enter the first address in the sub-block to allocate so that all 10 addresses are within your original block. You could enter 199.1.1.33, or 199.1.1.37, or any address between them. Note that if you entered 199.1.1.42 as the first address, network routing errors would probably result because you would be using a range with addresses that do not belong to your network (199.1.1.49, 199.1.1.50, and 199.1.1.51).

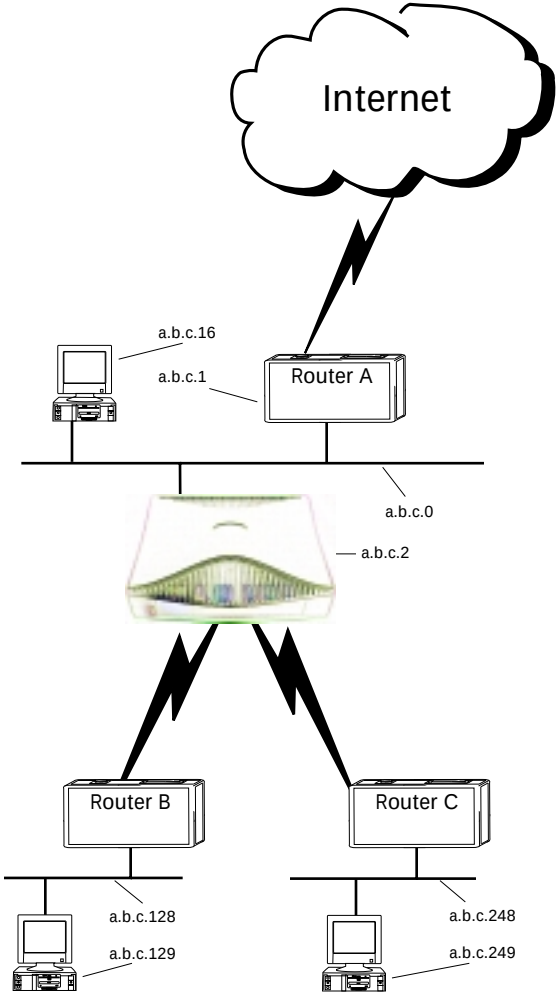
Nested IP subnets

Under certain circumstances, you may want to create remote subnets from the limited number of IP addresses issued by your ISP or other authority. You can do this using connection profiles. These subnets can be nested within the range of IP addresses available to your network.

For example, suppose that you obtain the Class C network address a.b.c.0 to be distributed among three networks. This network address can be used on your main network, while portions of it can be subnetted to the two remaining networks.

Note: The IP address a.b.c.0 has letters in place of the first three numbers to generalize it for this example.

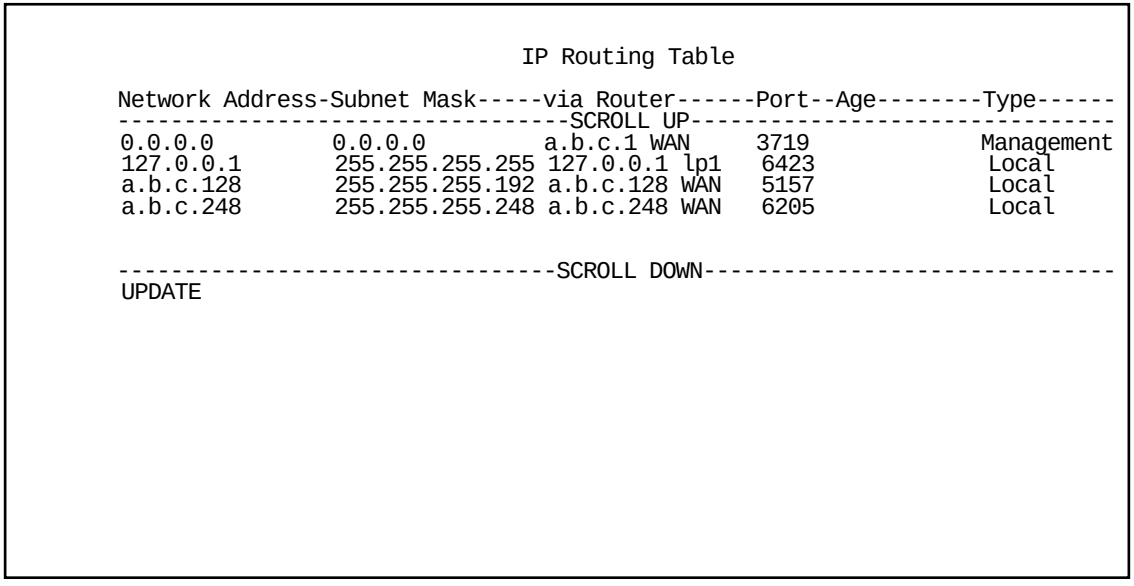
The following figure shows a possible network configuration exhibiting this scheme. The main network is set up with the Class C address a.b.c.0, and contains Router A (which could be a Netopia R5000 Series Router), a Netopia R5000 Series Router, and a number of other hosts. Router A maintains a link to the Internet and can be used as the default gateway.



Routers B and C (which could also be Netopia R5000 Series Routers) serve the two remote networks that are subnets of a.b.c.0. The subnetting is accomplished by configuring the Netopia R5000 Series Router with connection profiles for Routers B and C (see the following table).

Connection profile	Remote IP address	Remote IP mask	Bits available for host address
For Router B	a.b.c.128	255.255.255.192	7
For Router C	a.b.c.248	255.255.255.248	3

The Netopia R5000 Series Router's connection profiles for Routers B and C create entries in its IP routing table. One entry points to the subnet a.b.c.128, while a second entry points to the subnet a.b.c.248. The IP routing table might look similar to the following:



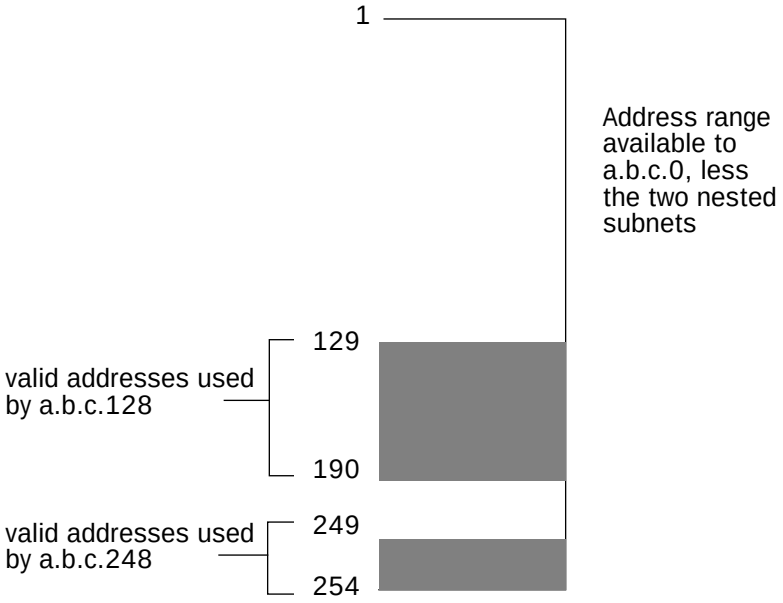
```
                                IP Routing Table

Network Address-Subnet Mask-----via Router------Port--Age--------Type------
-----------------------------------SCROLL UP-------------------------------
0.0.0.0         0.0.0.0         a.b.c.1 WAN     3719             Management
127.0.0.1       255.255.255.255 127.0.0.1 lp1   6423              Local
a.b.c.128       255.255.255.192 a.b.c.128 WAN   5157              Local
a.b.c.248       255.255.255.248 a.b.c.248 WAN   6205              Local


---------------------------------SCROLL DOWN-------------------------------
UPDATE
```

Let's see how a packet from the Internet gets routed to the host with IP address a.b.c.249, which is served by Router C. The packet first arrives at Router A, which delivers it to its local network (a.b.c.0). The packet is then received by the Netopia R5000 Series Router, which examines its destination IP address.

The Netopia R5000 Series Router compares the packet's destination IP address with the routes in its IP routing table. It begins with the route at the bottom of the list and works up until there's a match or the route to the default gateway is reached.

When a.b.c.249 is masked by the first route's subnet mask, it yields a.b.c.248, which matches the network address in the route. The Netopia R5000 Series Router uses the connection profile associated with the route to connect to Router C, and then forwards the packet. Router C delivers the packet to the host on its local network.

The following diagram illustrates the IP address space taken up by the two remote IP subnets. You can see from the diagram why the term nested is appropriate for describing these subnets.



Broadcasts

As mentioned earlier, binary IP host or subnet addresses composed entirely of ones or zeros are reserved for broadcasting. A broadcast packet is a packet that is to be delivered to every host on the network if both the host address and the subnet address are all ones or all zeros, or to every host on the subnetwork if the host address is all ones or all zeros but the subnet address is a combination or zeros and ones. Instead of making many copies of the packet, individually addressed to different hosts, all the host machines know to pay attention to broadcast packets, as well as to packets addressed to their specific individual host addresses. Depending on the age and type of IP equipment you use, broadcasts will be addressed using either all zeros or all ones, but not both. If your network requires zeros broadcasting, you must configure this through SNMP.

Packet header types

As previously mentioned, IP works with other protocols to allow communication over IP networks. When IP is used on an Ethernet network, IP works with the Ethernet or 802.3 framing standards, among other protocols. These two protocols specify two different ways to organize the very first signals in the sequence of electrical signals that make up an IP packet travelling over Ethernet. By default, the Netopia R5000 Series Router uses Ethernet packet headers for IP traffic. If your network requires 802.3 IP framing, you must configure this through SNMP.

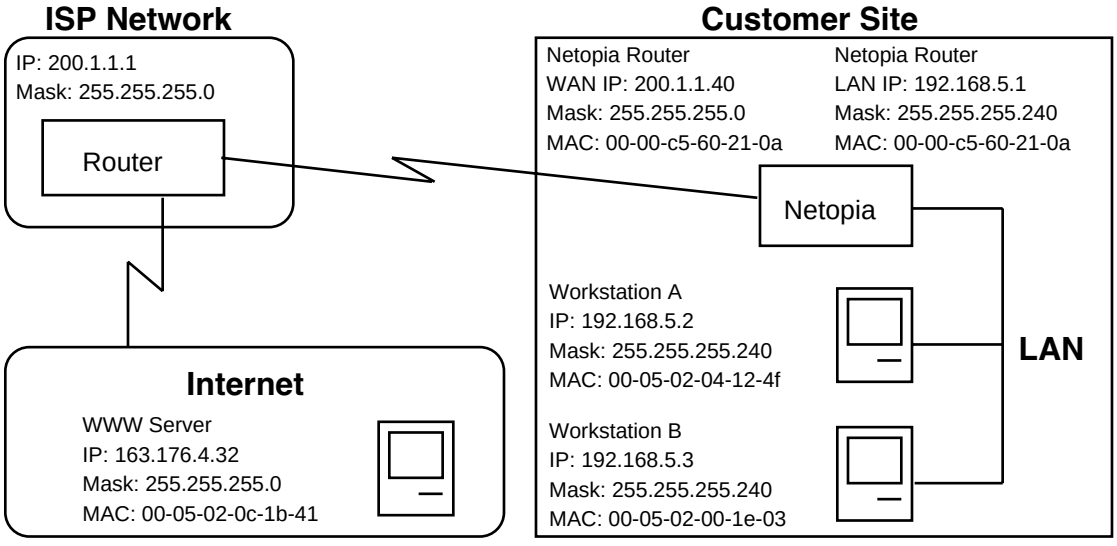
Appendix C

Understanding Netopia NAT Behavior

The Netopia R5000 Series Router implements a powerful feature called NAT as specified in RFC 1631. NAT is used for IP address conservation and for security purposes since there will only be a single IP "presence" on the WAN. This appendix describes the NAT functionality within the Netopia R5000 Series Router and provides examples for setup and use.

Network configuration

Below is a diagram of the network referenced in this appendix.



Background

NAT is a mechanism employed within the Netopia R5000 Series Router to acquire a statically or dynamically assigned IP address on its WAN interface and proxy against locally assigned IP addresses on its LAN interface. The Netopia R5000 Series Router uses a one-to-many IP address mapping scheme; that is against a single IP address the Netopia R5000 Series Router acquires on its WAN interface, the Netopia R5000 Series Router can proxy 14, 30, or an unlimited number of IP hosts on the LAN interface.

In order to fully understand how NAT works, you must understand how a PPP connection is established and IP addresses are negotiated.

When the Netopia R5000 Series Router establishes a connection over its WAN interface with another router it uses the Point-to-Point Protocol (PPP). Within PPP there is a Network Control Protocol (NCP) called Internet Protocol Control Protocol (IPCP), which handles the negotiation of IP addresses between the two routers, in this case the Netopia R5000 Series Router at the customer site above and the router at the Internet service provider (ISP).

If the Netopia R5000 Series Router calls the router at the ISP with NAT disabled, the Netopia negotiates its LAN interface address (as specified in IP Setup within the Netopia R5000 Series Router's console) with the router at the ISP through IPCP and then sets up routing. From the diagram on the previous page you can see that the address for the Netopia R5000 Series Router is 192.168.5.1 and the address of the router at the ISP is 200.1.1.1. Assuming that the addresses negotiated by the routers are valid and unique for the Internet, the Netopia R5000 Series Router and the hosts on its LAN would be able to access the Internet.

If the Netopia R5000 Series Router calls the router at the ISP with NAT enabled, instead of negotiating the LAN interface address, the Netopia R5000 Series Router suggests the address 0.0.0.0 through IPCP. When the router at the ISP sees this all-zeros IPCP request, the router can either pull a free dynamic IP address from its pool and assign it to the Netopia R5000 Series Router's WAN interface or, if configured to do so, it can match the Netopia R5000 Series Router's incoming connection profile and assign a preconfigured static IP address to the Netopia R5000 Series Router's WAN interface.

From the diagram, you can see that the IP address assigned to the Netopia R5000 Series Router's WAN interface is 200.1.1.40, while the IP address assigned to the LAN interface remains the same. The LAN interface address 192.168.5.1 is thus hidden from the ISP and the Internet, and the Netopia R5000 Series Router only has a single valid IP presence on the Internet. The LAN interface IP address for the Netopia R5000 Series Router can be any IP address; however, it is recommended that you use the IANA-specified 192.168.X.X Class C address range, which is used for networks not attached to the Internet. This address range is described in RFC 1597.

The dynamic IP address acquisition on the WAN interface of the Netopia R5000 Series Router is one of several features of NAT. Another is the mapping of locally assigned IP addresses to the single globally unique IP address acquired by the Netopia R5000 Series Router on its WAN interface. NAT employs several things to accomplish this seamlessly. You must look at the formatting of an IP packet before IP address remapping can be explained.

Every IP packet that is transmitted across the Netopia R5000 Series Router's LAN interface or across the WAN interface to the Internet contains several bits of information that indicate to any device where the packet is going and where it came from. In particular, you have the source and destination port and source and destination IP addresses.

A port is used within IP to define a particular type of service and could be either a Transmission Control Protocol (TCP) port or User Datagram Protocol (UDP) port. Both TCP and UDP are protocols that use IP as the underlying transport mechanism. The major difference between TCP and UDP is that TCP is a reliable delivery service, whereas UDP is a "best-effort" delivery service. A list of well-known TCP or UDP ports and services can be found in RFC 1700.

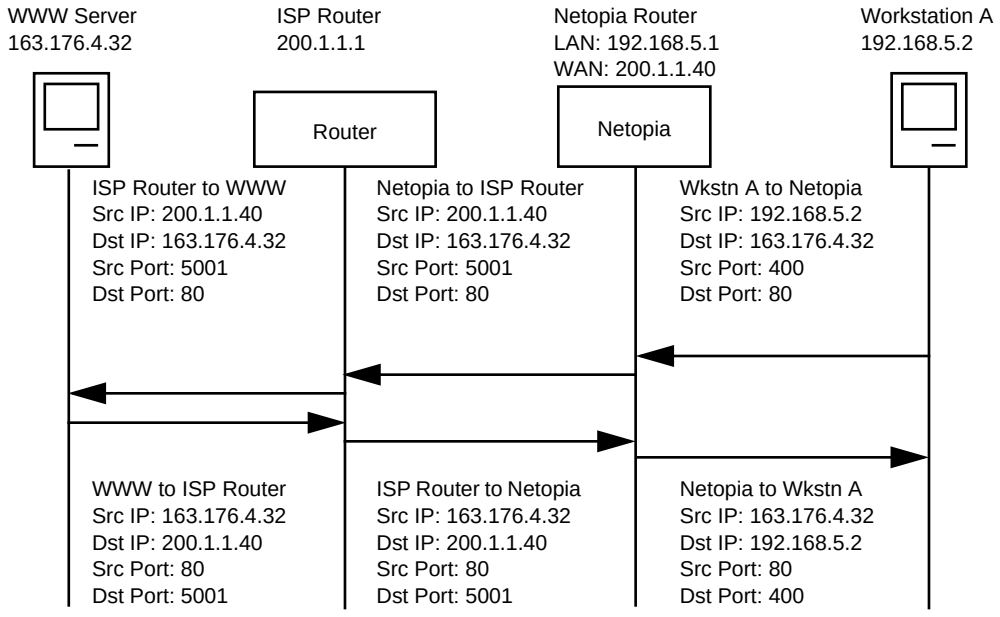
If Workstation A wants to communicate with a World Wide Web (WWW) server on the Internet and the Netopia R5000 Series Router does not have NAT enabled, Workstation A forms an IP packet with the source IP address of 192.168.5.2 and destination IP address of 163.176.4.32. The source port could be 400 while the destination port would be 80 (WWW server). The Netopia R5000 Series Router then looks at this IP packet, determines the best routing method and sends that packet on its way across the WAN interface to the WWW server on the Internet.

With NAT enabled, the Netopia R5000 Series Router does something different. For example, suppose that Workstation A again wants to communicate with the WWW server on the Internet. Workstation A forms an IP packet with the source IP address of 192.168.5.2 and destination IP address of 163.176.4.32, and source port could be 400 while the destination port would be 80 (WWW server).

When the Netopia R5000 Series Router receives this IP packet, it cannot simply forward it to the WAN interface and the Internet since the IP addresses on the LAN interface are not valid or globally unique for the Internet. Instead, the Netopia R5000 Series Router has to change the IP packet to reflect the IP address that was acquired on the WAN interface from the ISP.

The Netopia R5000 Series Router will first substitute the source IP address with the IP address that was acquired on the WAN interface, which in this case is 200.1.1.40. Next the Netopia R5000 Series Router will substitute the source TCP or UDP port with a TCP or UDP port from within a specified range maintained within the Netopia R5000 Series Router. And finally the modified IP packet's checksum is recalculated (as specified in RFC 1631) and the packet is transmitted across the WAN interface to its destination, the WWW server on the Internet.

If the send and response IP packets were drawn out, this process would look like the following:

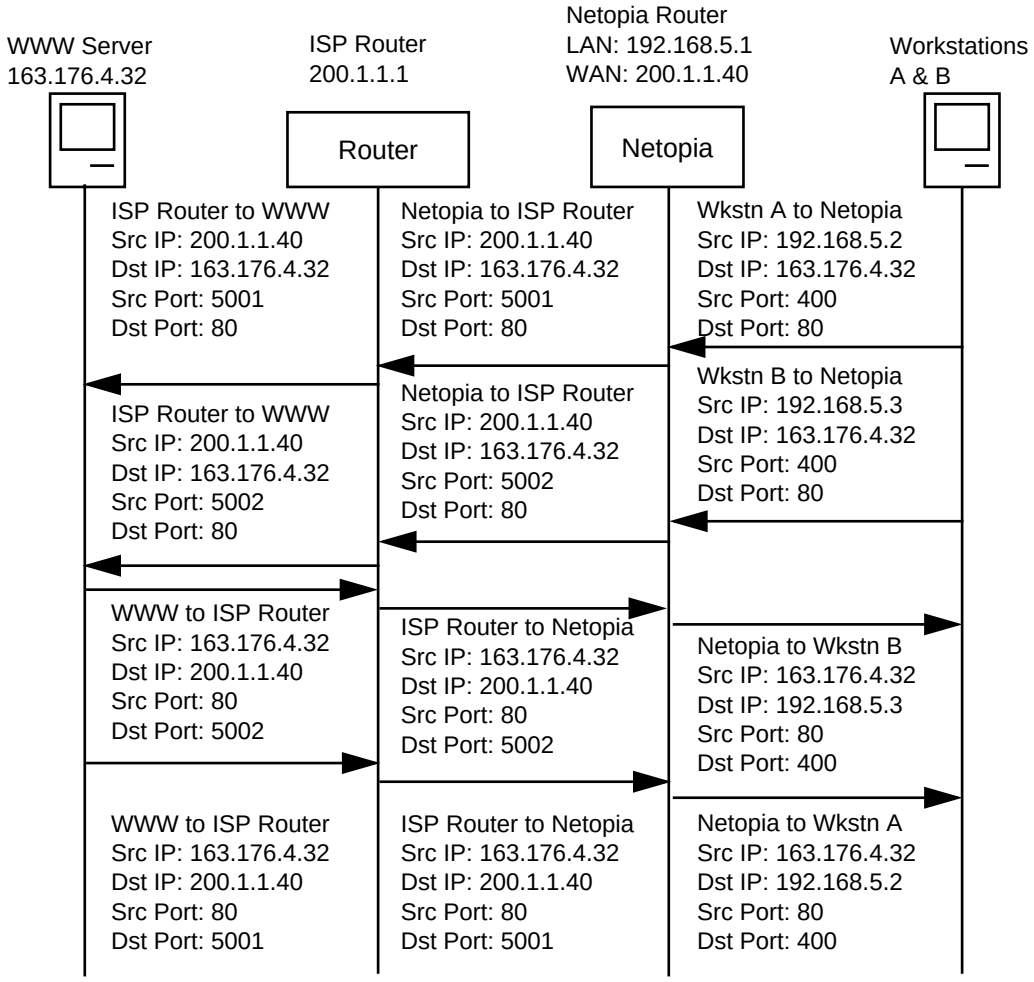


As you can see, the IP packet from Workstation A is sent to the Netopia R5000 Series Router, the source IP address is substituted with 200.1.1.40 and the source port is substituted with 5001, then the IP packet checksum is recalculated. When this modified packet reaches the WWW server on the Internet, the WWW server responds and sends the IP packet back to destination IP address 200.1.1.40 and destination port 5001.

When the Netopia R5000 Series Router receives this IP packet from the WWW server, the Netopia R5000 Series Router replaces the destination IP address with 192.168.5.2, the address for Workstation A. The port is changed back to 400, the IP packet checksum is recalculated, and the IP packet is sent to Workstation A on the Netopia R5000 Series Router's LAN interface.

The reasons for the IP address changes are obvious from the preceding diagram, but what is not so obvious is why the TCP or UDP source ports need to be changed as well. These are changed and maintained in an internal table so the Netopia R5000 Series Router can determine which host on the local LAN interface sent the IP packet and what host the response from the WAN interface is going to go to on the LAN interface. This becomes especially important when two or more hosts on the LAN interface are accessing the same type of service on the Internet, like a WWW server (port 80), for example.

Now look at how two hosts on the LAN interface accessing the same WWW server on the Internet will work:



As you can see, when Workstation A and Workstation B transmit an IP packet to the WWW server on the Internet, they have unique source IP addresses on the LAN interface but potentially the same source ports, which in this case is 400. When the Netopia R5000 Series Router receives these packets, the source IP addresses are substituted with the single globally unique IP address that was acquired on the WAN interface, which is 200.1.1.40.

Now both IP packets have the exact same source IP address (200.1.1.40) and source ports (400). The Netopia R5000 Series Router is then able to distinguish between the two IP packets by changing the source TCP or UDP ports and keeping this information in an internal table. As seen above, the source port for Workstation A has been changed to 5001 and the source port for Workstation B has been changed to 5002.

If you were to look at the internal port mapping table that is maintained by the Netopia R5000 Series Router, it would look similar to the following:

Source LAN IP	Source LAN Port	Remapped LAN Port
192.168.5.2	TCP 400	TCP 5001
192.168.5.3	TCP 400	TCP 5002

With this information the Netopia R5000 Series Router can determine the appropriate routing for an IP response from the Internet. In this case, when the WWW server responds with a destination port of 5001, the Netopia R5000 Series Router can see that this packet's destination on the local LAN interface is actually Workstation A at IP address 192.168.5.2. Likewise, with the response for port 5002, the Netopia R5000 Series Router can see that this packet's destination on the local LAN interface is actually Workstation B at IP address 192.168.5.3.

Exported services

Note that this “automatic” port remapping and IP address substitution only works in one direction – for IP packets that originated on the LAN interface destined to the WAN interface and the Internet. In order for port remapping and IP address substitution to work in the other direction – that is, hosts on the Internet that want to originate an IP packet destined to a host on the Netopia R5000 Series Router’s LAN interface – a manual redirection of TCP or UDP ports as well as destination IP addresses within the Netopia R5000 Series Router is required. This manual port remapping and IP address substitution is accomplished by setting up exported services.

Exported services are essentially user-defined pointers for a particular type of incoming TCP or UDP service from the WAN interface to a host on the local LAN interface. This is necessary since the Netopia R5000 Series Router and thus the attached local LAN has only one IP presence on the WAN interface and Internet. Exported services allows the user to redirect one type of service – for example Port 21 (FTP) – to a single host on the local LAN interface. This will then allow the Netopia R5000 Series Router to redirect any packets coming in from the Internet with the defined destination TCP or UDP port of port 21 (FTP) to be redirected to a host on the local LAN interface.

For example, suppose the WWW server on the Internet with the IP address of 163.176.4.32 wants to access Workstation B on the Netopia R5000 Series Router’s local LAN interface which is operating as an FTP server. The IP address for Workstation B is 192.168.5.3, which is not a valid IP address, and thus the WWW server on the Internet cannot use this IP address to access Workstation B.

The WWW server on the Internet would then have to use the single valid IP address that was acquired on the Netopia R5000 Series Router's WAN interface to access any host on the Netopia R5000 Series Router's local LAN interface, since this is the only valid address for the Internet. But if the WWW server on the Internet opens a connection to 200.1.1.40 via port 21 (FTP) and no exported services are defined on the Netopia R5000 Series Router, the Netopia R5000 Series Router will discard the incoming packet since the Netopia R5000 Series Router itself does not perform the requested service.

You can see why exported services are necessary. In the example above, an exported service needs to be defined within the Netopia R5000 Series Router redirecting any incoming IP traffic with a destination port of 21 to the host on the local LAN interface with the IP address of 192.168.5.3.

If the WWW server on the Internet then tries to open a connection to the IP address of 200.1.1.40 with the appropriate Exported Service defined, the Netopia R5000 Series Router will look at the destination port and will find that it is destined for port 21 (FTP). The Netopia R5000 Series Router then looks at the internal user-defined exported services table and finds that any incoming IP traffic from the WAN port with a destination of port 21 (FTP) should be redirected to the IP address of 192.168.5.3 on the local LAN interface, which in this case is Workstation B.

Once the appropriate exported services are defined, there can be seamless communication between a host on the Internet and a host on the Netopia R5000 Series Router's local LAN interface.

Important notes

Even with the advantages of NAT, there are several things you should note carefully:

- There is no formally agreed-upon method among router vendors for handling an all-zeros IPCP request. The majority of router vendors use the all-zeros IPCP request to determine when a dial-in host wants to be assigned an IP address. Some vendors however attempt to negotiate and establish routing with an all-zeros IP address. The Netopia R5000 Series Router will not allow routing to be established with an all-zeros IP address and the call will be dropped with an error logged in the Device Event History.
- When using NAT it is most likely that the Netopia R5000 Series Router will be receiving an IP address from a pool of dynamic IP addresses at the ISP. This means that the Netopia R5000 Series Router's IP presence on the Internet will change with each connection. This can potentially cause problems with devices on the Internet attempting to access services like WWW and FTP servers or AURP partners on the Netopia R5000 Series Router's local LAN interface. In this case, if a dynamic IP address is assigned to the WAN interface of the Netopia R5000 Series Router each time, the administrator of the Netopia R5000 Series Router will have to notify clients who want to access services on the Netopia R5000 Series Router's LAN interface of the new IP address after each connection.
- With NAT enabled, there cannot be two or more of the same types of service accessible from the Internet on the LAN interface of the Netopia R5000 Series Router. For example, there cannot be multiple FTP servers (Port 23) on the Netopia R5000 Series Router's LAN interface that can be accessible by workstations on the Internet. This is because there is no way within the Netopia R5000 Series Router and IP to distinguish between multiple servers using the same port, in this case port 23.
- Fictional IP addresses may be assigned on the Netopia R5000 Series Router's LAN interface. It is strongly recommended that for the Netopia R5000 Series Router's LAN interface, an IP address from the Class C address range of 192.168.X.X be used. This is because this range is defined by the IANA as an address space that will never be routed through the Internet and is to be used by private Intranets not attached to

the Internet.

If the address range of 192.168.X.X is not used and another range of addresses such as 100.1.1.X is used instead, this address space can potentially overlap an address space that is owned by a user attached to the Internet. Thus if a user on the Netopia R5000 Series Router's LAN interface has an IP address of 100.1.1.2 while the Netopia R5000 Series Router's LAN interface is 100.1.1.2 and the local host wants to access a host on the Internet with the address of 100.1.1.8, the Netopia R5000 Series Router has no way of knowing that the 200.1.1.8 address is actually on the Internet and not on its local LAN interface, since the local LAN interface is assigned the IP address range of 200.1.1.1 to 200.1.1.14.

Configuration

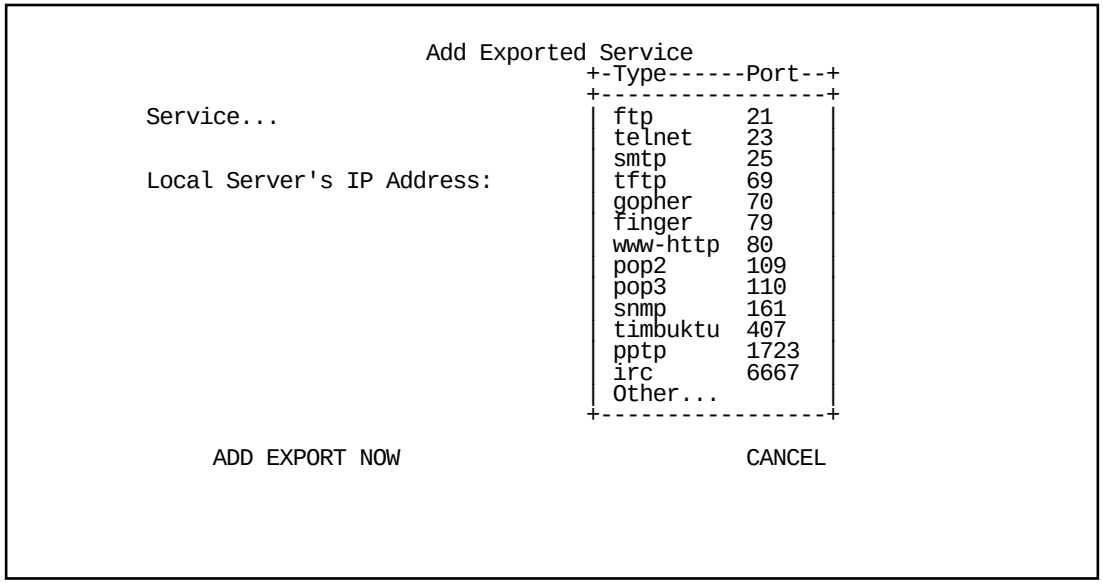
NAT is enabled by default with the SmartStart configuration utility. You can toggle **Enable Address Translation** to **No** or **Yes** in the Connection Profile screen in System Configuration under the IP Profile Parameters section. NAT is enabled on a per-profile basis, so it is possible to have any combination of NAT and non-NAT profiles. An example of enabling NAT is as follows:

```
                          IP Profile Parameters


        Remote IP Address:                 127.0.0.2
        Remote IP Mask:                    255.255.255.0

        Address Translation Enabled:       Yes

        Filter Set...
        Remove Filter Set

        Receive RIP:                       No









Enter the remote IP network's IP address (form xxx.xxx.xxx.xxx decimal).
Configure IP requirements for a remote network connection here.
```

Toggling **Address Translation Enabled** to Yes enables the Netopia R5000 Series Router to send out an all-zeros IPCP address that requests an IP to be assigned to the Netopia R5000 Series Router's WAN interface. Note that the remote IP address is 127.0.0.2, which should also be the default gateway under IP Setup in System Configuration. This is done for profile matching purposes and because the IP address of the router the Netopia R5000 Series Router is dialing is not always known.

As mentioned earlier in this appendix, NAT works well for IP sessions originated on the Netopia R5000 Series Router's LAN interface destined for the Internet without any additional configuration. For incoming IP connections from the Internet to a host on the Netopia R5000 Series Router's LAN interface, exported services need to be used.

Exported services are configured under IP Setup in System Configuration. This is where a particular type of TCP or UDP service originating from the Internet is redirected to a host on the Netopia R5000 Series Router's LAN interface. An example of this screen follows:



Within exported services is a pop-up list of well-known TCP and UDP services that can be redirected to a single host on the Netopia R5000 Series Router's LAN interface. There is also an **Other...** option that allows for manual configuration of additional TCP or UDP ports. You can define a total of 32 exported services.

When a particular type of service is redirected to an IP address, that service is removed from the pop-up list, since only one type of service can be redirected to a single host. However several different types of services can be redirected to a single or multiple hosts. For example, port 80 (WWW server) could be redirected to 192.168.5.3 on the Netopia R5000 Series Router's LAN interface, and port 23 (Telnet) can be redirected to that same host.

Summary

NAT is a powerful feature of the Netopia R5000 Series Router and when used and set up properly can yield a secure network while only using one IP address on the WAN interface. Note that the addresses listed in this appendix are for demonstration purposes only. Do not use these addresses when configuring your local network.

Appendix D

Binary Conversion Table

This table is provided to help you choose subnet numbers and host numbers for IP and MacIP networks that use subnetting for IP addresses.

Decimal	Binary	Decimal	Binary	Decimal	Binary	Decimal	Binary
0	0	32	100000	64	1000000	96	1100000
1	1	33	1000001	65	1000001	97	1100001
2	10	34	100010	66	1000010	98	1100010
3	11	35	100011	67	1000011	99	1100011
4	100	36	100100	68	1000100	100	1100100
5	101	37	100101	69	1000101	101	1100101
6	110	38	100110	70	1000110	102	1100110
7	111	39	100111	71	1000111	103	1100111
8	1000	40	101000	72	1001000	104	1101000
9	1001	41	101001	73	1001001	105	1101001
10	1010	42	101010	74	1001010	106	1101010
11	1011	43	101011	75	1001011	107	1101011
12	1100	44	101100	76	1001100	108	1101100
13	1101	45	101101	77	1001101	109	1101101
14	1110	46	101110	78	1001110	110	1101110
15	1111	47	101111	79	1001111	111	1101111
16	10000	48	110000	80	1010000	112	1110000
17	10001	49	110001	81	1010001	113	1110001
18	10010	50	110010	82	1010010	114	1110010
19	10011	51	110011	83	1010011	115	1110011
20	10100	52	110100	84	1010100	116	1110100
21	10101	53	110101	85	1010101	117	1110101
22	10110	54	110110	86	1010110	118	1110110
23	10111	55	110111	87	1010111	119	1110111
24	11000	56	111000	88	1011000	120	1111000
25	11001	57	111001	89	1011001	121	1111001
26	11010	58	111010	90	1011010	122	1111010
27	11011	59	111011	91	1011011	123	1111011
28	11100	60	111100	92	1011100	124	1111100
29	11101	61	111101	93	1011101	125	1111101
30	11110	62	111110	94	1011110	126	1111110
31	11111	63	111111	95	1011111	127	1111111

Decimal	Binary	Decimal	Binary	Decimal	Binary	Decimal	Binary
128	10000000	160	10100000	192	11000000	224	11100000
129	10000001	161	10100001	193	11000001	225	11100001
130	10000010	162	10100010	194	11000010	226	11100010
131	10000011	163	10100011	195	11000011	227	11100011
132	10000100	164	10100100	196	11000100	228	11100100
133	10000101	165	10100101	197	11000101	229	11100101
134	10000110	166	10100110	198	11000110	230	11100110
135	10000111	167	10100111	199	11000111	231	11100111
136	10001000	168	10101000	200	11001000	232	11101000
137	10001001	169	10101001	201	11001001	233	11101001
138	10001010	170	10101010	202	11001010	234	11101010
139	10001011	171	10101011	203	11001011	235	11101011
140	10001100	172	10101100	204	11001100	236	11101100
141	10001101	173	10101101	205	11001101	237	11101101
142	10001110	174	10101110	206	11001110	238	11101110
143	10001111	175	10101111	207	11001111	239	11101111
144	10010000	176	10110000	208	11010000	240	11110000
145	10010001	177	10110001	209	11010001	241	11110001
146	10010010	178	10110010	210	11010010	242	11110010
147	10010011	179	10110011	211	11010011	243	11110011
148	10010100	180	10110100	212	11010100	244	11110100
149	10010101	181	10110101	213	11010101	245	11110101
150	10010110	182	10110110	214	11010110	246	11110110
151	10010111	183	10110111	215	11010111	247	11110111
152	10011000	184	10111000	216	11011000	248	11111000
153	10011001	185	10111001	217	11011001	249	11111001
154	10011010	186	10111010	218	11011010	250	11111010
155	10011011	187	10111011	219	11011011	251	11111011
156	10011100	188	10111100	220	11011100	252	11111100
157	10011101	189	10111101	221	11011101	253	11111101
158	10011110	190	10111110	222	11011110	254	11111110
159	10011111	191	10111111	223	11011111	255	11111111

Appendix E

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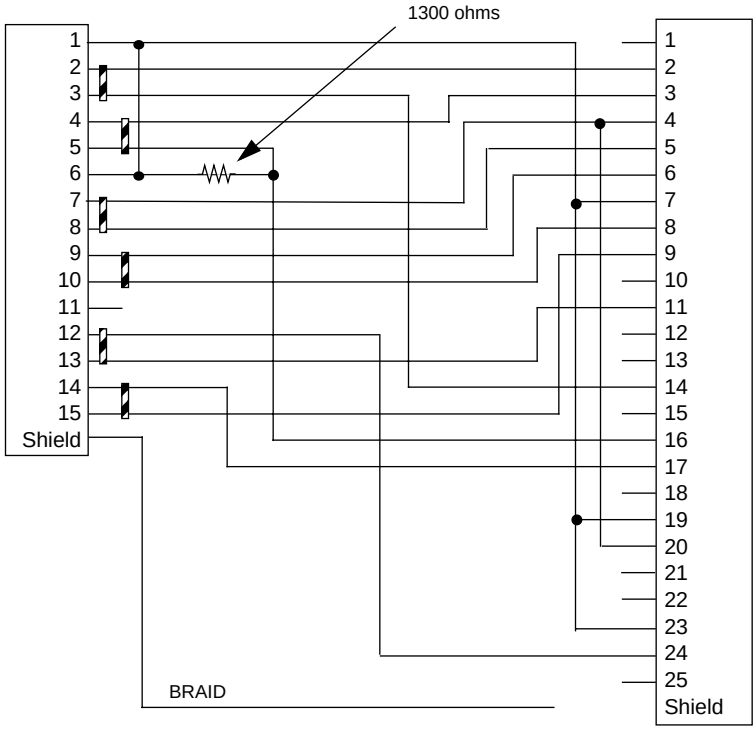
Appendix F

Technical Specifications and Safety Information

Pinouts for Auxiliary port modem cable



HD-15		DB-25	
Pin 1	Ground	Pin 1	(not used)
Pin 2	TDA	Pin 2	TD
Pin 3	TDB	Pin 3	RD
Pin 4	RDA	Pin 4	RTS
Pin 5	RDB	Pin 5	CTS
Pin 6	(not used)	Pin 6	DCE Ready
Pin 7	DTR	Pin 7	Ground

HD-15		DB-25	
Pin 8	CTS	Pin 8	RLSD
Pin 9	DSR	Pin 9	-RSET (EIA-530)
Pin 10	DCD	Pin 10	(not used)
Pin 11	(not used)	Pin 11	-TSET (EIA-530)
Pin 12	TCA	Pin 12	(not used)
Pin 13	TCB	Pin 13	(not used)
Pin 14	RCA	Pin 14	-TD (EIA-530) STD (EIA-232)
Pin 15	RCB	Pin 15	(not used)
		Pin 16	-RD (EIA-530) SRD (EIA-232)
		Pin 17	RSET
		Pin 18	(not used)
		Pin 19	-RTS (EIA-530) SRTS (EIA-232)
		Pin 20	DTE Ready
		Pin 21	(not used)
		Pin 22	(not used)
		Pin 23	Ground
		Pin 24	TSET
		Pin 25	(not used)

Note: Certain RS-232 modems do not properly accept signals on pins 12/24, 13/11, 14/17, and 15/9. For these applications, these pins may need to be cut.

Description

Dimensions: 124.0 cm (w) x 20.0 cm (d) x 5.3 cm (h)
9.4” (w) x 7.9” (d) x 2.1” (h)

Communications interfaces: The Netopia R5000 Series Router has an RJ-45 jack for WAN line connections; an 8–port 10Base-T Ethernet hub for your LAN connection; a DB-9 Console port; and an HD-15 Auxiliary port that can be used as either a serial or LocalTalk port.

Power requirements

- 12 VDC input
- 1.5 amps

Environment

Operating temperature: 0° to +40° C

Storage temperature: 0° to +70° C

Relative storage humidity: 20 to 80% noncondensing

Software and protocols

Software media: Software preloaded on internal flash memory; field upgrades done via download to internal flash memory via XMODEM or TFTP

Routing: TCP/IP Internet Protocol Suite, RIP, AppleTalk*, LocalTalk-to-Ethernet routing*, AURP tunneling*, MacIP*, IPX

* Optional add-on feature

WAN support: PPP, HDLC, Frame Relay

Security: PAP, CHAP, PAP-TOKEN, CACHE-TOKEN, callback, SecurID, IP/IPX firewalls, UI password security, and CallerID

SNMP network management: SNMPv1, MIB-II (RFC 1213), Interface MIB (RFC 1229), Ethernet MIB (RFC 1643), AppleTalk MIB-I (1243), Netopia R5000 Series Router MIB

Management/configuration methods: HTTP (Web server), serial console, remote modem console, Telnet, SNMP

Diagnostics: Ping, event logging, routing table displays, traceroute, statistics counters, web-based management

Agency approvals

North America (R5100, R5200, R5300)

Safety Approvals:

- United States – UL: 1950 Third Edition
- Canada – CSA: CAN/CSA-C22.2 No. 950-95

EMI:

- FCC Class B

International (R5100)

Safety Approvals:

- Low Voltage (European directive) 72/23
- EN60950 (Europe)
- ETSI 300 047 (Europe)
- AS/NRZ 3260 (Australia)
- TS001(Australia)
- TS008 (Australia)

EMI Compatibility:

- 89/336/EEC (European directive)
- EN55022:1994 CISPR22 Class B
- EN550082-1:1992 (Immunity)

Network Homologation:

- Telecom Terminal Equipment, CTR1 and 2
- TS031 (Australia)

Regulatory notices

Warnings

This is a Class B product. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate measures. Adequate measures include increasing the physical distance between this product and other electrical devices.

Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

United States (R5100, R5200, R5300). This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio TV technician for help.

FCC Requirements, Part 68 (R5200, R5300). The Federal Communications Commission (FCC) has established Rules which permit this device to be directly connected to the telephone network. Standardized jacks are used for these connections. This equipment should not be used on party lines or coin phones.

If this device is malfunctioning, it may also be causing harm to the telephone network; this device should be disconnected until the source of the problem can be determined and until repair has been made. If this is not done, the telephone company may temporarily disconnect service.

The telephone company may make changes in its technical operations and procedures; if such changes affect the compatibility or use of this device, the telephone company is required to give adequate notice of the changes. You will be advised of your right to file a complaint with the FCC.

If the telephone company requests information on what equipment is connected to their lines, inform them of:

a) The telephone number to which this unit is connected.

b) The ringer equivalence number

c) The USOC jack required. (RJ11C)

d) The FCC Registration Number. (14 digits provided by FCC)

Items (b) and (d) are indicated on the label. The Ringer Equivalence Number (REN) is used to determine how many devices can be connected to your telephone line. In most areas, the sum of the REN's of all devices on any one line should not exceed five (5.0). If too many devices are attached, they many not ring properly.

Service requirements. In the event of equipment malfunction, all repairs should be performed by our Company or an authorized agent. Under FCC rules, no customer is authorized to repair this equipment. This restriction applies regardless of whether the equipment is in or our of warranty. It is the responsibility of users requiring service to report the need for service to our Company or to one of our authorized agents. Service can be obtained at Netopia, Inc., 2470 Mariner Square Loop, Alameda, California, 94501.

Important

This product was tested for FCC compliance under conditions that included the use of shielded cables and connectors between system components. Changes or modifications to this product not authorized by the manufacturer could void your authority to operate the equipment.

Canada. This Class B digital apparatus meets all requirements of the Canadian Interference -Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Réglement sur le matériel brouilleur du Canada.

Declaration for Canadian users

(R5200, R5300)

The Canadian Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operation, and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to the certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

Caution

Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

The load number (LN) assigned to each terminal device denotes the percentage of the total load to be connected to a telephone loop that is used by the device to prevent overloading. The termination on a loop may consist of any combination of devices subject only to the requirement that the total of the load numbers of all the devices does not exceed 100.

Important safety instructions

Australian Safety Information (R5100)

The following safety information is provided in conformance with Australian safety requirements:

CAUTION: DO NOT USE BEFORE READING THE INSTRUCTIONS: Do not connect the Ethernet, Phone 1 and Phone 2 ports to a carrier or carriage service provider's telecommunications network or facility unless: a) you have the written consent of the network or facility manager, or b) the connection is in accordance with a connection permit or connection rules.

Connection of the Ethernet, Phone 1, and Phone 2 ports may cause a hazard or damage to the telecommunication network or facility, or persons, with consequential liability for substantial compensation.

Caution

- The direct plug-in power supply serves as the main power disconnect; locate the direct plug-in power supply

near the product for easy access.

- For use only with CSA Certified Class 2 power supply, rated 12VDC, 1.5A.

Telecommunication installation cautions

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.
- Avoid using a telephone (other than a cordless type) during an electrical storm. There may be a remote risk of electric shock from lightning.
- Do not use the telephone to report a gas leak in the vicinity of the leak.

Battery

The Netopia R5000 Series Router's lithium battery is designed to last for the life of the product. The battery is not user-serviceable.

Caution!

Danger of explosion if battery is incorrectly replaced.

Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

Glossary

access line: A telephone line reaching from the telephone company central office to a point usually on your premises. Beyond this point the wire is considered inside wiring.

analog: In telecommunications, telephone transmission and/or switching that is not digital. An analog phone transmission is one that was originally intended to carry speech or voice, but may with appropriate modifications be used to carry data of other types.

ANSI (American National Standards Institute): Devises and proposes recommendations for international communications standards. See also *CCITT*.

AppleTalk: A comprehensive network system designed and developed by Apple Computer, Inc. AppleTalk allows many different types of computer systems, printers, and servers to communicate on a variety of cabling schemes, including LocalTalk and Ethernet cabling. In this manual, AppleTalk refers especially to the protocols or rule sets that govern this communication.

AppleTalk address: A unique identifier for each device using AppleTalk that allows information to be sent and received correctly. An AppleTalk address always includes a network number wherever two or more AppleTalk networks are connected together by routers.

AURP (Apple Update-based Router Protocol): An enhanced AppleTalk routing protocol. AURP provides improved support for AppleTalk over wide area networks (WANs) and tunneling through non-AppleTalk (IP) networks. AURP features include network number remapping, clustering of remote network numbers, and hop count reduction.

backbone: A network topology consisting of a single length of cable with multiple network connection points.

bandwidth: The range of frequencies, expressed in Kilobits per second, that can pass over a given data transmission channel within a network. The bandwidth determines the rate at which information can be sent through a channel - the greater the bandwidth, the more information that can be sent in a given amount of time.

BAP (Bandwidth Allocation Protocol): Protocol that manages the dynamic bandwidth allocation of implementations supporting the PPP Multilink protocol. This is done by defining the Bandwidth Allocation Protocol (BAP), as well as its associated control protocol, the Bandwidth Allocation Control Protocol (BACP). BAP can be used to manage the number of links in a multilink bundle.

baud rate: The rate of the signaling speed of a transmission medium.

bit: A binary digit; the smallest unit of data in the binary counting system. A bit has a value of either 0 or 1.

bits per second (bps): A measure of the actual data transmission rate. The bps rate may be equal to or greater than the baud rate, depending on the modulation technique used to encode bits into each baud interval. The correct term to use when describing modem data transfer speeds.

bps: See *bits per second*.

branch: A length of cable in a star network that goes from the center of the star to a wall jack.

broadcast: A network transaction that sends data to all hosts connected to the network.

burstiness: Data that uses bandwidth only sporadically; that is, information that does not use the total bandwidth of a circuit 100 percent of the time. During pauses, channels are idle, and no traffic flows across them in either direction. Interactive and LAN-to-LAN data is bursty in nature, because it is sent intermittently. Between data transmissions the channel experiences idle time waiting for the DTEs to respond to the transmitted data user's input or waiting for the user to send more data.

byte: A group of bits, normally eight, which represent one data character.

CallerID: See *CND.*

CCITT (Comite Consultatif International Telegraphique et Telephonique): International Consultative Committee for Telegraphy and Telephony, a standards organization that devises and proposes recommendations for international communications. See also *ANSI (American National Standards Institute)*.

CHAP (Challenge Handshake Protocol): A method for ensuring secure network access and communications.

Class A, B, and C networks: The values assigned to the first few bits in an IP network address determine which class designation the network has. In decimal notation, Class A network addresses range from 1.X.X.X to 126.X.X.X, Class B network addresses range from 128.1.X.X to 191.254.X.X, and Class C addresses range from 192.0.1.X to 223.255.254.X. For more information on IP network address classes, see Appendix B, "Understanding IP Addressing."

client: An intelligent workstation that makes requests to other computers known as servers. PC computers on a LAN can be clients.

clustering: A feature that clusters remapped network numbers into a range of sequential network numbers.

CNA (Calling Number Authentication): A security feature that will reject an incoming call if it does not match the Calling Number field in one of the Netopia Router's connection profiles.

CND (Calling Number Delivery): Also known as caller ID, a feature that allows the called customer premises equipment (CPE) to receive a calling party's directory number during the call establishment phase.

community strings: Sequences of characters that serve much like passwords for devices using SNMP. Different community strings may be used to allow an SNMP user to gather device information or change device configurations.

CRC (Cyclic Redundancy Check): A computational means to ensure the integrity of a block of data. The mathematical function is computed, before the data is transmitted at the originating device. Its numerical value is computed based on the content of the data. This value is compared with a recomputed value of the function at the destination device.

DCE (Data Communications Equipment): Term defined by standards committees that applies to communications equipment, typically modems or printers, as distinct from other devices that attach to the network, typically personal computers or data terminals (DTE). The distinction generally refers to which pins in an RS-232-C connection transmit or receive data. Also see *DTE*.

DDP (Datagram Delivery Protocol): Defines socket-to-socket delivery of datagrams over an AppleTalk internet.

default zone: When a Phase II EtherTalk network includes more than one zone, all routers on that network must be configured to assign one of these zones as a default zone. The default zone is temporarily assigned to any Phase II EtherTalk node that hasn't chosen a zone. The user may choose another zone by opening the Network Control Panel, selecting the correct physical connection, and then choosing a zone in the scrolling field displayed.

DLCI: Data Link Connection Identifier. The Frame Relay network provides a number of virtual circuits that form the basis for connections between stations attached to the same Frame Relay network. The resulting set of interconnected devices forms a private Frame Relay group which may be either fully interconnected with a complete "mesh" of virtual circuits, or only partially interconnected. In either case, each virtual circuit is uniquely identified at each Frame Relay interface by a Data Link Connection Identifier (DLCI). In most circumstances, DLCIs have strictly local significance at each Frame Relay interface.

DHCP (Dynamic Host Configuration Protocol): A service that lets clients on a LAN request configuration information, such as IP host addresses, from a server.

DNS (Domain Name Service): A TCP/IP protocol for discovering and maintaining network resource information distributed among different servers.

download: The process of transferring a file from a server to a client.

DTE (Data Terminal Equipment): Term defined by standards committees that applies to communications equipment, typically personal computers or data terminals, as distinct from other devices that attach to the network, typically modems or printers (DCE). The distinction generally refers to which pins in an RS-232-C connection transmit or receive data. Pins 2 and 3 are reversed. Also see *DCE*.

EIA (Electronic Industry Association): A North American standards association.

Ethernet: A networking protocol that defines a type of LAN characterized by a 10 Mbps (megabits per second) data rate. Ethernet is used in many mainframe, PC, and UNIX networks, as well as for EtherTalk.

Ethernet address: Sometimes referred to as a hardware address. A 48-bits long number assigned to every Ethernet hardware device. Ethernet addresses are usually expressed as 12-character hexadecimal numbers, where each hexadecimal character (0 through F) represents four binary bits. Do not confuse the Ethernet address of a device with its network address.

EtherTalk: Apple's data-link software that allows an AppleTalk network to be connected by Ethernet cables. EtherTalk is a protocol within the AppleTalk protocol set. Two versions of EtherTalk are in common use, designated as Phase I and Phase II EtherTalk.

extended network: A network using AppleTalk Phase II protocols; EtherTalk 2.0 and TokenTalk are extended networks. LocalTalk networks are compatible with Phase II but are not extended because a single LocalTalk network cannot have multiple network numbers or multiple zone names.

firmware: System software stored in a device's memory that controls the device. The Netopia Router's firmware can be updated.

gateway: A device that connects two or more networks that use different protocols. Gateways provide address translation services, but do not translate data. Gateways must be used in conjunction with special software packages that allow computers to use networking protocols not originally designed for them.

hard seeding: A router setting. In hard seeding, if a router that has just been reset detects a network number or zone name conflict between its configured information and the information provided by another router, it disables the router port for which there is a conflict. See also *non-seeding, seeding*, *seed router,* and *soft seeding*.

HDLC (High-Level Data Link Control): A generic link-level communications protocol developed by the International Organization for Standardization (ISO). HDLC manages synchronous, code-transparent, serial information transfer over a link connection. See also *SDLC (Synchronous Data Link Control).*

header: In packets, a header is part of the envelope information that surrounds the actual data being transmitted. In e-mail, a header is usually the address and routing information found at the top of messages.

hop: A single traverse from one node to another on a LAN.

hop count: The number of nodes (routers or other devices) a packet has gone through. If there are six routers between source and destination nodes, the hop count for the packet will be six when it arrives at its destination node. The maximum allowable hop count is usually 15.

hop count reduction: A feature of AURP supported by the Netopia Router. Tunnels and point-to-point links over WANs can often exceed the maximum allowable hop count of 15 routers. Network administrators can use the hop count reduction feature to set up tunnels and point-to-point links that exceed the 15-router limit.

host: A single, addressable device on a network. Computers, networked printers, and routers are hosts.

host computer: A communications device that enables users to run applications programs to perform such functions as text editing, program execution, access to data bases, etc.

internet: A set of networks connected together by routers. This is a general term, not to be confused with the large, multi-organizational collection of IP networks known as the Internet. An internet is sometimes also known as an internetwork.

internet address, IP address: Any computing device that uses the Internet Protocol (IP) must be assigned an internet or IP address. This is a 32-bit number assigned by the system administrator, usually written in the form of 4 decimal fields separated by periods, e.g., 192.9.200.1. Part of the internet address is the IP network number (IP network address), and part is the host address (IP host address). All machines on a given IP network use the same IP network number, and each machine has a unique IP host address. The system administrator sets the subnet mask to specify how much of the address is network number and how much is host address. See also *Class A, B, and C networks*.

IP (Internet Protocol): A networking protocol developed for use on computer systems that use the UNIX operating system. Often used with Ethernet cabling systems. In this manual, IP is used as an umbrella term to cover all packets and networking operations that include the use of the Internet Protocol. See also *TCP/IP*.

IP address, IP host address, IP network address: See *internet address*.

IP broadcast: See *broadcast*.

IP tunneling: See *AURP*.

IPX (Internet Packet Exchange): A protocol used by Novell NetWare networks.

ISDN (Integrated Services Digital Network): A method of transmitting data digitally over telephone lines.

ISP (Internet service provider): A company that provides Internet-related services. Most importantly, an ISP provides Internet access services and products to other companies and consumers.

ITU (International Telecommunication Union): United Nations specialized agency for telecommunications. Successor to CCITT.

LAN (local area network): A privately-owned network that offers high-speed communications channels to connect information processing equipment in a limited geographic area.

LocalTalk: The cabling specification for AppleTalk running at a speed of 230.4 kbps (kilobits per second).

MacIP: A protocol in which IP packets are encapsulated within AppleTalk headers, for transmission over AppleTalk networks. MacIP requires the presence of at least one AppleTalk–IP gateway. MacIP is usually used to allow an AppleTalk computer to communicate with an IP computer.

MacIP client: A Macintosh computer that is using the MacIP protocol to communicate with an IP computer.

MIB (management information base): A standardized structure for SNMP management information.

modem: A device used to convert digital signals from a computer into analog signals that can be transmitted across standard analog (not ISDN) telephone lines. Modem is a contraction of modulator-demodulator.

NAT (Network Address Translation): A feature that allows communication between the LAN connected to the Netopia Router and the Internet using a single IP address, instead of having a separate IP address for each computer on the network.

NetBIOS: A network communications protocol used on PC LANs.

network: A group of computer systems and other computer devices that communicate with one another.

network administrator: A person who coordinates the design, installation, and management of a network. A network administrator is also responsible for troubleshooting and for adding new users to the network.

network log: A record of the names of devices, location of wire pairs, wall-jack numbers, and other information about the network.

network number: A unique number for each network in an internet. AppleTalk network numbers are assigned by seed routers, to which the network is directly connected. An isolated AppleTalk network does not need a network number.

network number remapping: Resolves network number conflicts when two or more AppleTalk networks that may have duplicate network numbers are connected together. The Netopia Router lets you set up a range of network numbers into which remote AppleTalk network numbers are remapped.

network range: A unique set of contiguous numbers associated with an extended network; each number in a network range can be associated with up to 253 node addresses.

node: See *host*.

non-seeding: A router setting that causes it to request network number and zone information from any other routers on the network connected to the non-seeding port. If it receives this information, it begins to route packets through that port. See also *hard seeding, seeding*, *seed router,* and *soft seeding*.

packet: A group of fixed-length binary digits, including the data and call control signals, that are transmitted through an X.25 packet-switching network as a composite whole. The data, call control signals, and possible error control information are arranged in a predetermined format. Packets do not always travel the same pathway but are arranged in proper sequence at the destination side before forwarding the complete message to an addressee.

packet-switching network: A telecommunications network based on packet-switching technology, wherein a transmission channel is occupied only for the duration of the transmission of the packet.

PAP (PPP authentication protocol): A method for ensuring secure network access.

parameter: A numerical code that controls an aspect of terminal and/or network operation. Parameters control such aspects as page size, data transmission speed, and timing options.

port: A location for passing data in and out of a device, and, in some cases, for attaching other devices or cables.

port number: A number that identifies a TCP/IP-based service. Telnet, for example, is identified with TCP port 23.

POTS (plain old telephone service): Ordinary analog telephone service such as that used for voice transmission, as distinct from digital service.

PPP (Point-to-Point Protocol): A protocol for framing IP packets and transmitting them over a serial line.

protocol: A set of rules for communication, sometimes made up of several smaller sets of rules also called protocols. AppleTalk is a protocol that includes the LocalTalk, EtherTalk, and TokenTalk protocols.

remapping: See *network number remapping*.

RFC (Request for Comment): A series of documents used to exchange information and standards about the Internet.

RIP (Routing Information Protocol): A protocol used for the transmission of IP routing information.

RJ-11: A telephone-industry standard connector type, usually containing four pins.

RJ-45: A telephone-industry standard connector type, usually containing eight pins.

router: A device that supports network communications. A router can connect identical network types, such as LocalTalk-to-LocalTalk, or dissimilar network types, such as LocalTalk-to-Ethernet. However—unless a gateway is available—a common protocol, such as TCP/IP, must be used over both networks. Routers may be equipped to provide WAN line support to the LAN devices they serve. They may also provide various management and monitoring functions as well as a variety of configuration capabilities.

router port: A physical or logical connection between a router and a network. Where a network only allows the use of one protocol, each physical connection corresponds to one logical router port. An example is the Netopia Router's LocalTalk port. Where a network allows the use of several protocols, each physical connection may correspond to several logical router ports—one for each protocol used. Each router port has its own network address.

routing table: A list of networks maintained by each router on an internet. Information in the routing table helps the router determine the next router to forward packets to.

SDLC (Synchronous Data Link Control): A link-level communications protocol used in an International Business Machines (IBM) Systems Network Architecture (SNA) network that manages synchronous, code-transparent, serial information transfer over a link connection. SDLC is a subset of the more generic HDLC (High-Level Data Link Control) protocol developed by the International Organization for Standardization (ISO).

seeding: A method for ensuring that two or more routers agree about which physical networks correspond to which network numbers and zone names. There are three options: non-seeding, soft seeding, and hard seeding. Seeding can often be set separately for each router port. See also *hard seeding*, *non-seeding, seed router,* and *soft seeding*.

seed router: A router that provides network number and zone information to any router that starts up on the same network. See also *hard seeding*, *non-seeding, seeding,* and *soft seeding*.

serial port: A connector on the back of the workstation through which data flows to and from a serial device.

server: A device or system that has been specifically configured to provide a service, usually to a group of clients.

SNMP (Simple Network Management Protocol): A protocol used for communication between management consoles and network devices. The Netopia Router can be managed through SNMP.

soft seeding: A router setting. In soft seeding, if a router that has just been reset detects a network number or zone name conflict between its configured information for a particular port and the information provided by another router connected to that port, it updates its configuration using the information provided by the other router. See also *hard seeding*, *non-seeding, seeding,* and *seed router*.

subnet: A network address created by using a subnet mask to specify that a number of bits in an internet address will be used as a subnet number rather than a host address.

subnet mask: A 32-bit number to specify which part of an internet address is the network number and which part is the host address. When written in binary notation, each bit written as 1 corresponds to 1 bit of network address information. One subnet mask applies to all IP devices on an individual IP network.

TCP/IP (Transmission Control Protocol/Internet Protocol): An open network standard that defines how devices from different manufacturers communicate with each other over one or more interconnected networks. TCP/IP protocols are the foundation of the Internet, a worldwide network of networks connecting businesses, governments, researchers, and educators.

telephone wall cable: 2-pair, 4-pair, or 8-pair, 22- or 24-gauge solid copper wire cable. Telephone wall cable is sometimes called telephone station cable or twisted-pair cable.

TFTP (Trivial File Transfer Protocol): A protocol used to transfer files between IP nodes. TFTP is often used to transfer firmware and configuration information from a UNIX computer acting as a TFTP server to an IP networking device, such as the Netopia Router.

UDP (User Datagram Protocol): A TCP/IP protocol describing how packets reach applications in destination nodes.

wall jack: A small hardware component used to tap into telephone wall cable. An RJ-11 wall jack usually has four pins; an RJ-45 wall jack usually has eight pins.

WAN (wide area network): A network that consists of nodes connected by long-distance transmission media, such as telephone lines. WANs can span a state, a country, or even the world.

WAN IP: In addition to being a router, the Netopia Router is also an IP address server. There are four protocols it can use to distribute IP addresses over the WAN which include: DHCP, BootP, IPCP, and MacIP.

wiring closet: A central location where a building's telephone and network wiring is connected. Multi-story buildings often have a main wiring closet in the basement and satellite wiring closets on each floor.

zone: An arbitrary subset of nodes within an AppleTalk internet. Creating multiple zones makes it easier for users to locate network services. The network administrator defines zones when he or she configures routers. Isolated networks have no zones. LocalTalk and EtherTalk Phase I networks may have no more than one zone each. EtherTalk Phase II and TokenTalk networks may have more than one zone each. Several networks of any AppleTalk type may share a zone name.

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In order to make a claim under this warranty you must comply with the following procedure:

1. Contact Netopia Customer Service within the warranty period to obtain a Return Materials Authorization ("RMA") number.
2. Return the defective Product and proof of purchase, shipping prepaid, to Netopia with the RMA number prominently displayed on the outside of the package.

If you are located outside of the United States or Canada, please contact your dealer in order to arrange for warranty service.

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